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ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

ELECTRICAL SYSTEMS

serving new 2300-foot arrival building at New York's International Air Terminal.

page 67

ESTIMATING FORUM –

Direct job costs applied to labor and material.

page 75

UNDERGROUND FEEDER

system increases capacity for 51-building state hospital.

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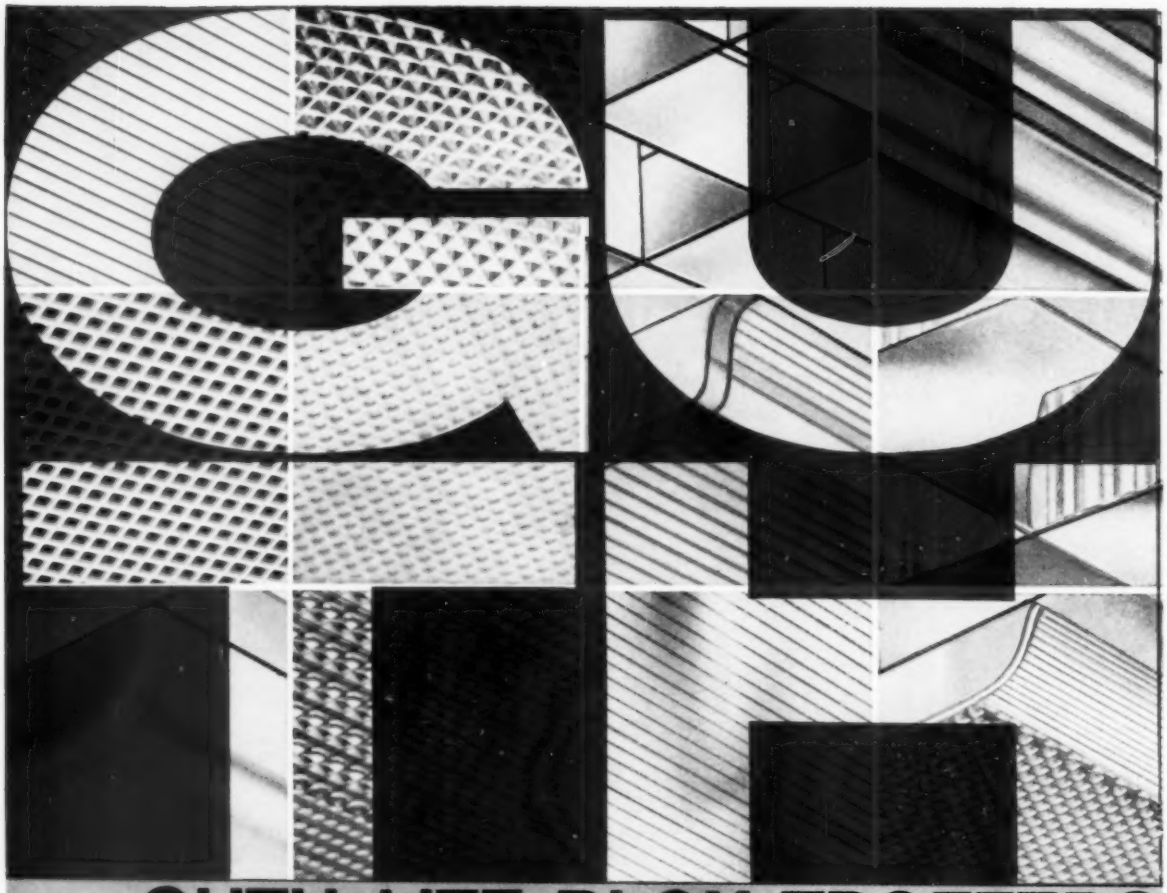
A McGRAW-HILL PUBLICATION 57TH YEAR



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the quality line with unlimited variations

Guth Lite-Blox troffers are *carefully engineered, precision made* and cover practically every type of troffer job you can name . . . for almost every ceiling suspension system:

Long or Short—Slim or Wide! 1′ x 2′, 1′ x 4′, 1′ x 6′, 1′ x 8′, 2′ x 2′, 2′ x 4′.

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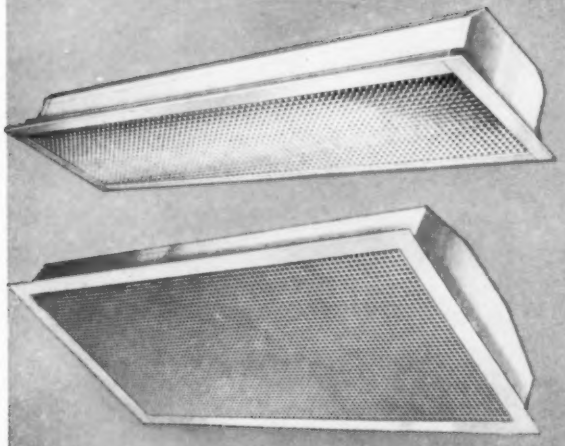
Speedier Maintenance! Bottoms can be hinged from either side for quick re-lamping and cleaning.



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*®U. S. and Can. Pats. Pend.
†U. S. Pat. 2,745,001, Can. Pats. 1957, 538,243

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Added to Square D Oil-Tight Pushbutton Line

Completely oil-tight, even when depressed

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Positive contact "feel" in test position

No additional panel space required

Choice of 6 color caps

Full range of voltage ratings

Mounts interchangeably with oil-tight pushbuttons and selector switches

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Selector Switch

Coin-Operated Selector Switch

Key-Operated Selector Switch

Selector Pushbutton

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Selector Switch and Pushbutton Lockout

4-Position Joystick Operator

Wobble Stick Operator

Neoprene Cap

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Easy to use • Operators require only a single mounting hole for quicker installation. Pressure wire connectors mean simplified wiring.

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Small size • Only a minimum of panel and back-of-panel space is required.

Variety of contacts • Contact block arrangements include single-pole double-circuit, duplex double-circuit, tandem duplex, three-position duplex, and overlapping contacts.

• • •

***FOR COMPLETE INFORMATION** on oil-tight pushbuttons, send for Bulletin 9001-T to Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.*

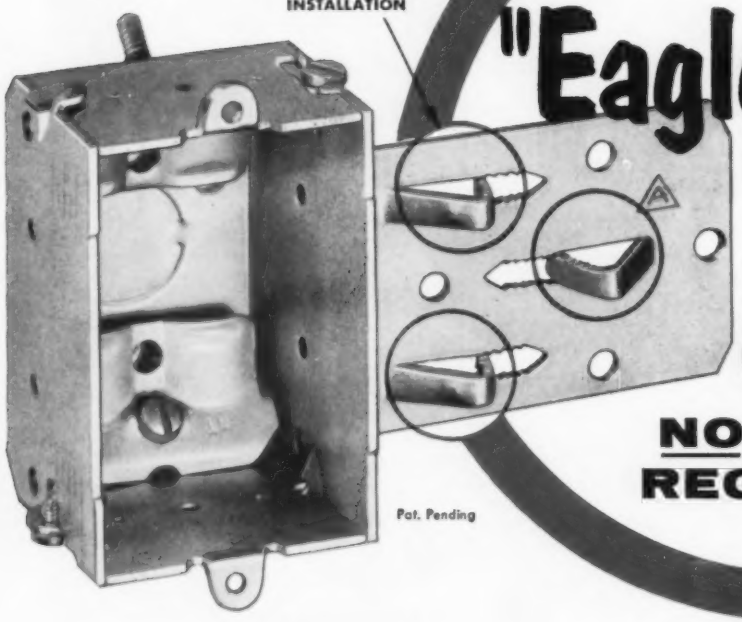
EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

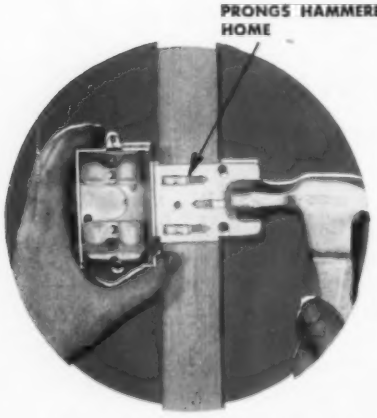
APPLETON announces another First!

new

"Eagle Claw" Box



NO NAILS REQUIRED!



There are holes at end of bracket for the rare occasion when switch box must be set on studding at full length of bracket.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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Sidelights

NATIONAL ELECTRICAL WEEK

National Electrical Week, sponsored by the leading electrical trade associations and many other electrical industry groups, is expected to enlist more participation this year by contractors, distributors, manufacturers and utilities than ever before. The Week, an opportunity for all of the industry to tell its story in terms of better living, is now in its third year. It will be observed February 9 to 15.

CHURCH ELECTRICAL MODERNIZATION

A concentrated attack on a New England church by termites gave the parishioners the alternative of abandoning the building or proceeding with an extensive refurnishing, redecorating and structural rehabilitation job. The decision to renovate also led to an electrical modernization project including new distribution, lighting, low-voltage control and high-fidelity sound features. The traditional ecclesiastical atmosphere of the edifice was greatly enhanced by the practical modernization plan. Lighting and other electrical features were installed by the Morey Pike Electrical Co. and are described in "Objective Lighting Plan" beginning on page 87.

DETECTING COMMUTATION TROUBLES

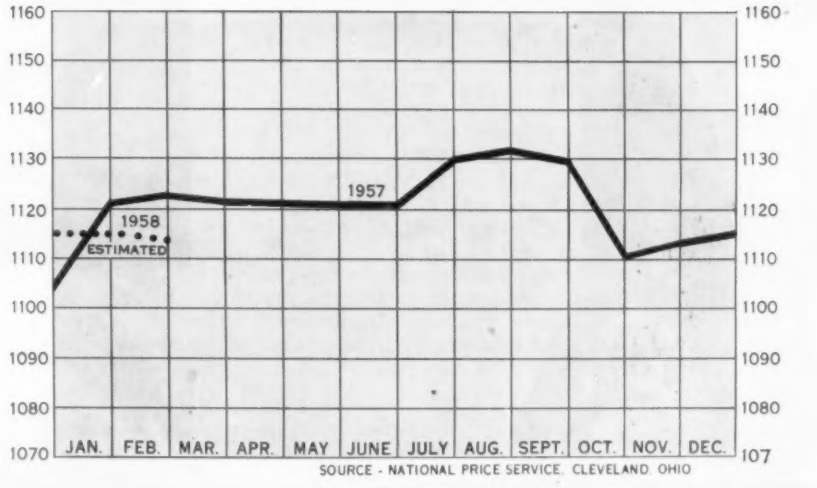
"Commutator criminals" and how to catch them by observing the "clues" of potential trouble is a practical who-done-it for those who have the responsibility for the care and maintenance of dc electrical machinery. J. V. Dobson and D. R. Dobson of Stackpole Carbon tell what to look for and how to recognize and interpret the signs of impending commutator and brush problems so that corrective measures can be taken before minor faults become serious. Their article begins on page 92.

COST MANUAL

One of the most important new books in many years for electrical construction engineers and estimators has recently come off the press. *Electrical Construction Cost Manual*, by Ralph Edgar Johnson, president, Sturgeon Electric Company, Denver, Colo. (McGraw-Hill Book Co., $10.00) establishes fundamental methods for installing electrical work, develops standard assemblies for varying conditions, sets up unit costs for each assembly and gives detailed estimating procedures.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



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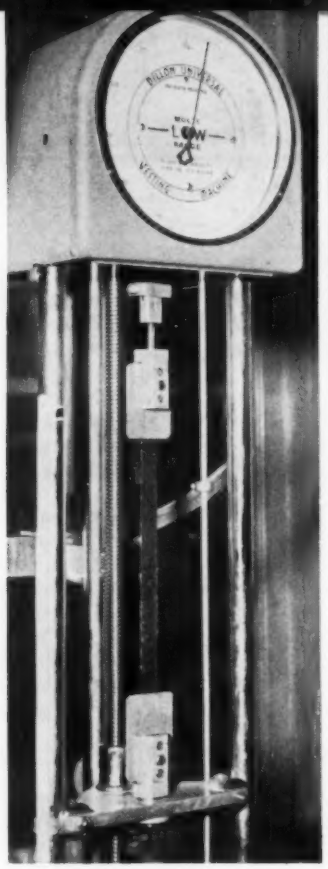

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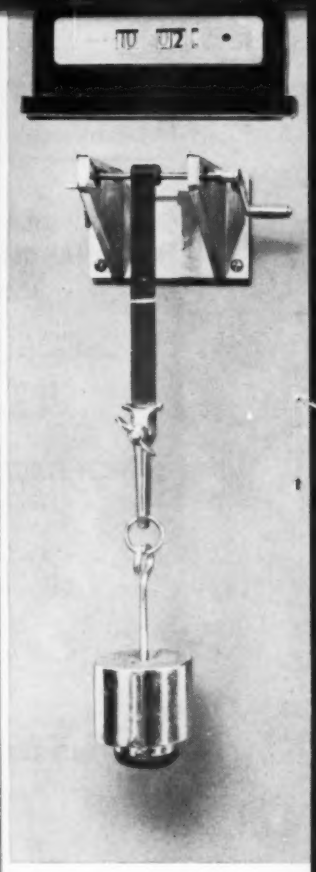

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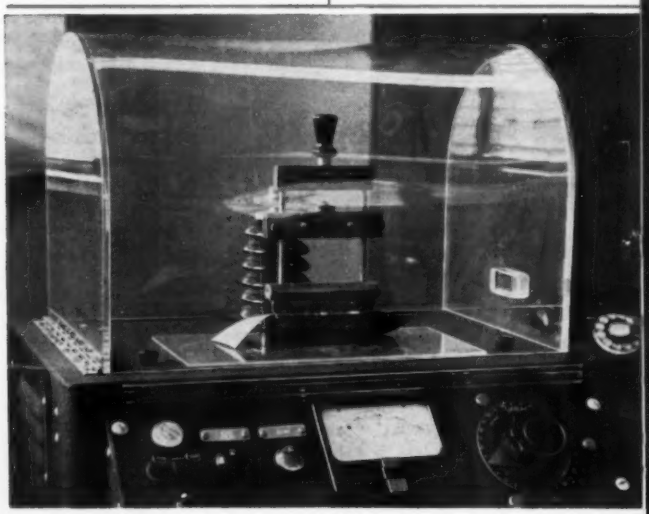

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Washington Report

Business is in a declining trend, most Washington officials admit, but report that pessimism is lessening. Economic weaknesses are being overplayed, they claim, as defense spending turns upward, credit is further eased, residential building shows some new life, and local and state public spending continues to increase.

The business outlook following recent changed government spending prospects is for continued "softness" during the first half of 1958, followed by a pickup in the last half of the year. Most major industries —autos and steel excepted—view the year ahead with optimism, in spite of the current business slump, Commerce Department reported.

Career officials now head all 24 industry divisions of the Business and Defense Services Administration (Dept. of Commerce), it was reported recently, as directors for the last eight divisions were announced. New director for the Power Equipment Division is Ellsworth J. Hand, and for the Electrical Equipment Division is Carney G. Laslie, Jr.

Five year-end reports were issued by Electrical Equipment Division, BDSA, summarizing 1957 activities and stating the outlook for 1958. For the electrical industry as a whole, 1957 ended with a general weakening of markets for electrical equipment, the reports stated. Shipments in 1957 were 4% ahead of 1956. It is anticipated that 1958 will show slight gains over last year, and a long-range view shows the industry growing at a more rapid rate than the total gross national product, the report stated, but no spectacular single year advances are anticipated. Detailed reports covered four major subdivisions: high voltage transmission and distribution equipment, rotating equipment and industrial controls, low-voltage equipment, and lighting.

More accurate statistics on building construction are predicted by Commerce Department, in announcing a top-level decision to merge the Bureau of Labor Statistics operation with the Commerce Department's operation. Exact date of the merger has not been announced.

Last year's new construction total was estimated at $47.3 billion by Dept. of Commerce, a 3% gain over 1956 dollar-wise, but about the same in terms of physical volume. This was the first yearly slowdown in 12 years, the report said. Forecast for this year is another record total of $49.6 billion, or a gain of 5% over last year. Most of this gain, the forecast said, will be in residential building and on highway work.

Housing starts in December dropped to 62,000, down from 78,000 in November and from 63,600 a year earlier. Starts for last year were 950,000, and estimated for this year will be 1,100,000.

Government spending for highway construction will be stepped up this year, Commerce Secretary Weeks has reported. Over $3 billion had been committed for the Federal interstate highway system by the end of last October, the Bureau of Public Roads said.

The electric power industry plans record expenditures of $3.9 billion for expansion this year, and will account for an addition of 16.2 million kilowatts of new generating capacity. But the year-to-year weekly record gain in electric output has now slowed to less than 3%, removing some of the pressure for increases in capacity.

Work on a second airport to serve the nation's capital has been started, on President Eisenhower's orders, at Chantilly, Va., about 25 miles west of Washington. It is expected to cost some $40 to $50 million.

Builder Richard Schoen (left) and Architect Pierre Zoelly at the site of their ultra-modern home for Mr. and Mrs. Paul Decker in the Surrey Hill area of Columbus.

"Planned telephone outlets help a modern home stay modern"

—says Mr. Richard Schoen, Custom Builder, of Columbus, Ohio

"My customers want their homes to be modern today and modern tomorrow, too," says Mr. Schoen. "Among the many conveniences I plan with the future in mind are telephone outlets, with the wiring neatly concealed in the walls.

"I discuss these telephone outlets with every customer, and we consider not only present needs, but anticipated future requirements also. The way I see it, every house I build can be a lasting advertisement for me here in Columbus. And planning for telephone outlets is one good way to insure that my homes are going to stay modern and desirable for a long time to come, as well as please customers and help sales today."

* * *

Your local Bell Telephone business office will be glad to help you with concealed wiring plans. For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

Working together to bring people together

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NOW! NEW! FABULOUS LUXWOOD® FIXTURES

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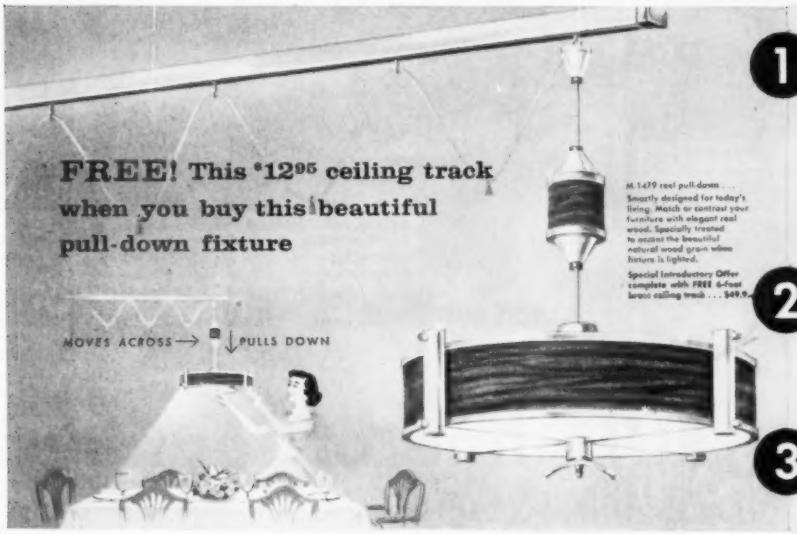
FREE OFFER! INTRODUCTORY PRICES! FULL PROFITS!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M-1479 reel pull-down . . . Smartly designed for today's living. Match or contrast your furniture with elegant real wood. Specially treated to accent the beautiful natural wood grain when fixture is lighted.
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2 FREE OFFER

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3 SPECIAL INTRODUCTORY PRICES

Reduced 30 day introductory prices to consumers . . . and you get your FULL PROFIT because you get special prices too!

4 POWERFUL PROMOTION

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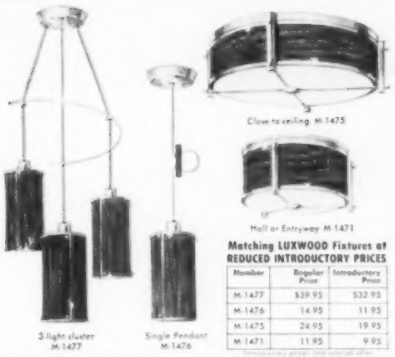

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Number	Regular Price	Introductory Price
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M-1476	14.95	11.95
M-1475	24.95	19.95
M-1471	11.95	9.95

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LUXWOOD®

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translucent fixtures of real wood

Here is LUXWOOD—most exciting lighting fixture idea years . . . real cabinet grain wood trimmed in gleaming brass . . . actually translucent when lighted. Five matching fixtures to dramatize every room in your home.

To introduce LUXWOOD fixtures your dealer will give you a 6 foot brass ceiling track FREE (regular retail price $12.95) when you buy the M-1479 pull-down fixture shown above at the regular price of $49.95.

With the polished brass ceiling track and LUXWOOD pull-down fixture you can move the light up or down and 6 feet in either direction. Beautiful over dining tables, breakfast nooks or conversation furniture groupings . . . it's a conversation piece in itself.

Matching Luxwood fixtures by Moe Light are perfect for redecorating home, office or store. Get these matching fixtures at special low introductory prices.

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Builders, Electrical Contractors attach this coupon to your letterhead for copy of Moe Light catalog.

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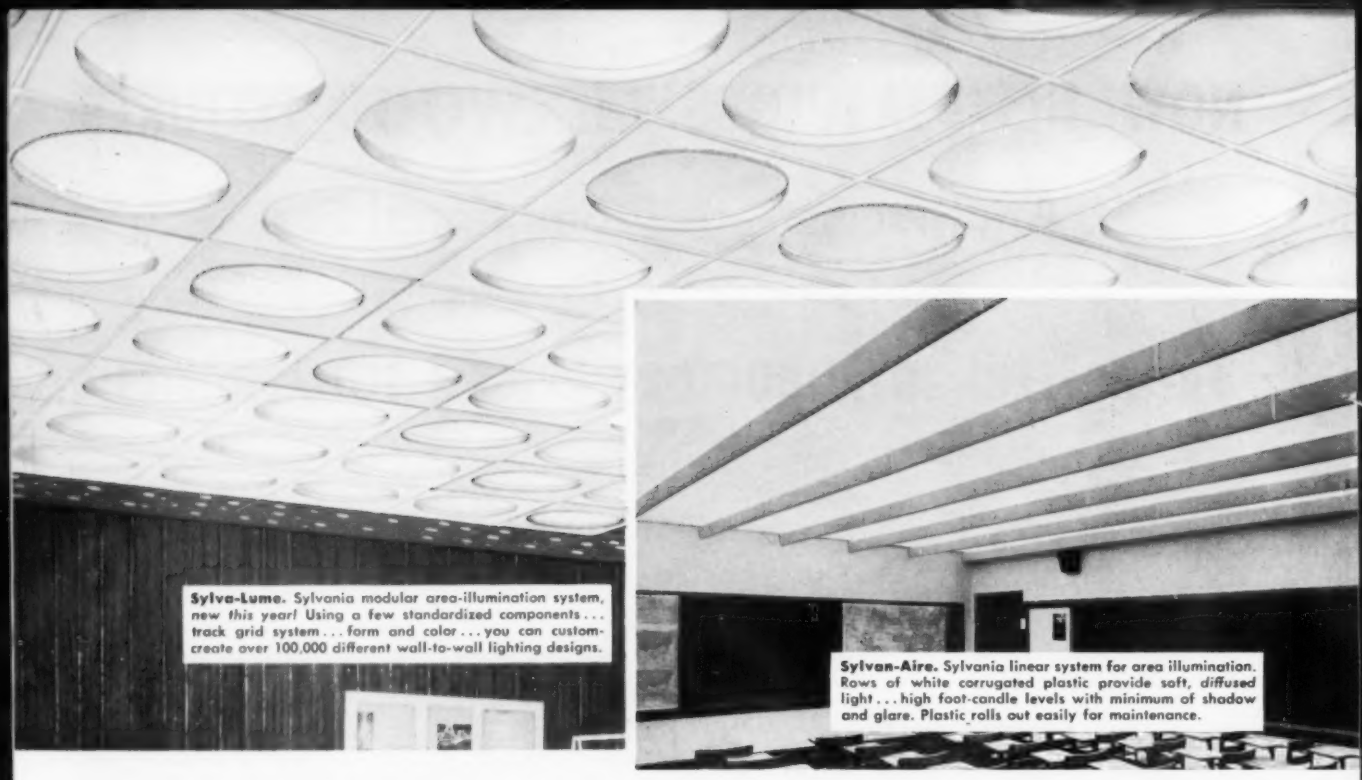


Sylva-Lume. Sylvania modular area-illumination system, *new this year!* Using a few standardized components... track grid system... form and color... you can custom-create over 100,000 different wall-to-wall lighting designs.

Sylvan-Aire. Sylvania linear system for area illumination. Rows of white corrugated plastic provide soft, *diffused* light... high foot-candle levels with minimum of shadow and glare. Plastic rolls out easily for maintenance.

Your FULL line of featured

The Scott—now in coral, too. Exclusive molded plastic shielding. Extremely high 89.8% illumination efficiency. Colors: White, eye-rest green, and new coral.

Mohawk Series. Smart 3¾" *shallow* series for quick surface-mounting on today's low ceilings.

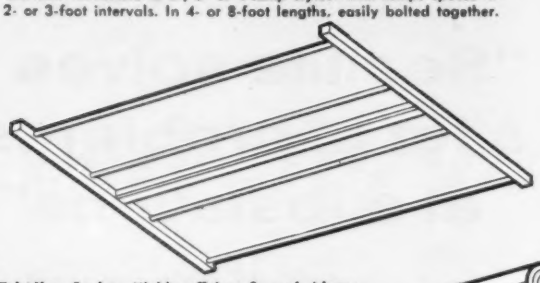
One- and 2-foot widths, 24 different stylings including choice of shielding.

Diamond-"I" Series with 25% upward light

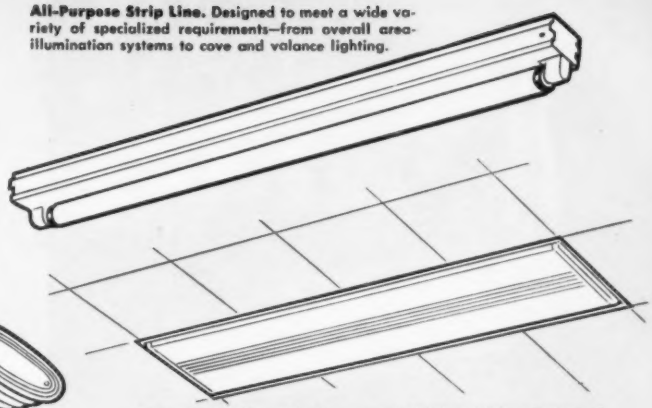
Latest Industrial Types. Meet or exceed RLM specs for plant lighting with increased upward light components.

NTWS Series with 10% upward light

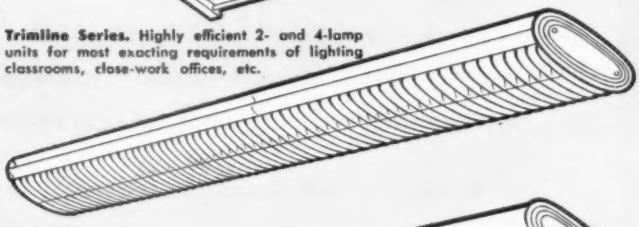
New "Outrigger" Fixture. Great timesaver and economical short cut for wall-to-wall lighting. Combines several lamps, spaced, on one unit. Available in 2-, 3- or 4-lamp styles—with lamps spaced at 2- or 3-foot intervals. In 4- or 8-foot lengths, easily bolted together.



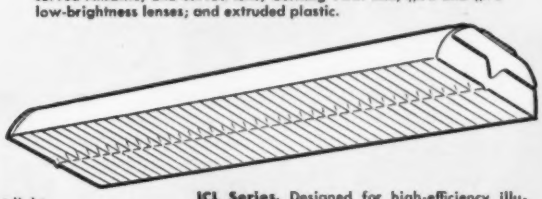
All-Purpose Strip Line. Designed to meet a wide variety of specialized requirements—from overall area-illumination systems to cove and valance lighting.

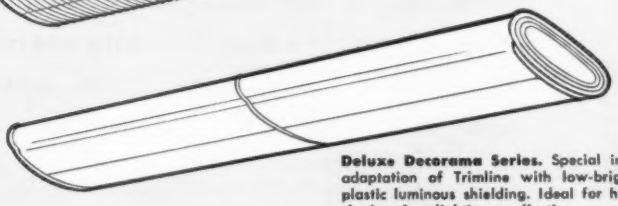


Trimline Series. Highly efficient 2- and 4-lamp units for most exacting requirements of lighting classrooms, close-work offices, etc.



Sylvania Troffers. Classic recessed lighting. Wide selection of shielding: 45° x 45° louvers, Corning flat-ribbed Albalite glass, curved Albalite, and curved lens; Corning Twin-Lite, #70 and #72 low-brightness lenses; and extruded plastic.





Deluxe Decorama Series. Special indirect-light adaptation of Trimline with low-brightness all-plastic luminous shielding. Ideal for high-quality, shadow-free lighting applications.

ICL Series. Designed for high-efficiency illumination with a strong downward component. Distribution is 40% upward light, 60% downward light.

SYLVANIA

Lighting Systems and Fixtures

blazing a long, long trail of product advantages

. . . to spur your sales

Every time you install a Sylvania Lighting System or Fixture, it speaks well for you . . . *sells* for you. You can depend on it to look and perform the way discriminating customers expect it to. It will label your work as true craftsmanship.

Shown on these pages are several modern lighting systems and fixtures—the *featured* Sylvania line. Here are lighting ideas, new thinking, modern aesthetic designs. And here is the finest lighting performance that money can buy, both in quantity and quality of light delivered.

Sell Sylvania—and link your name to the finest brand in lighting.

. . . to chop your costs

Sylvania's real payoff for you: precious man-hour savings on the job with fewer call-backs after the installation is completed.

Safe labor-saving devices are traditionally Sylvania's star attraction. Some are built in, some come as optional or low-cost accessories. The many man-hours saved are your assurance of substantial profits and greater leeway for job-winning bids.

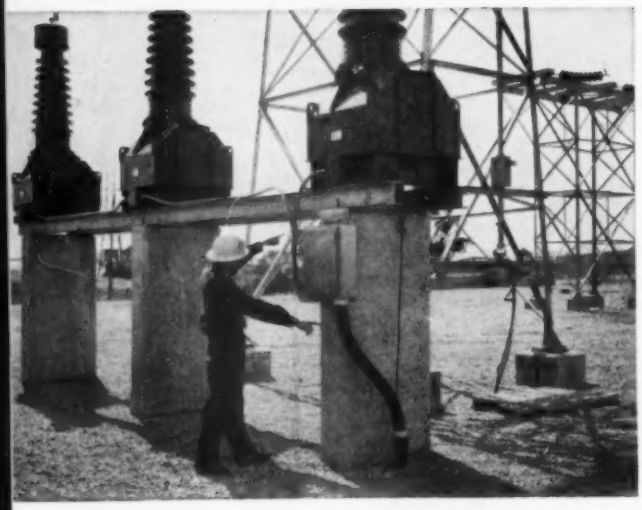
We suggest you look over the few Sylvania Fixtures and Systems shown here. Then ask your **Sylvania Fix**ture Specialist or Select Distributor for full details. Write direct for complete catalog and the name of your nearest distributor.

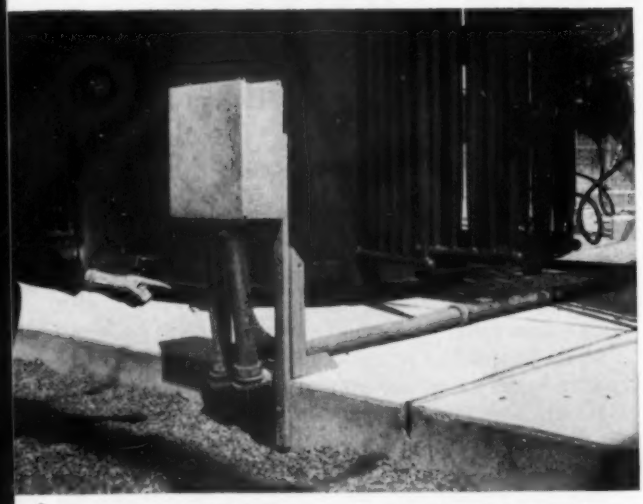
SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.
Dept. B40, Lighting Division—Fixtures
One 48th Street, Wheeling, W. Va.

. . . fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY





1 Sealtite—installed at Perry, New York, substation, New York State Electric & Gas Corp., on supervisory carrier current control equipment. **2** Sealtite is also used between 115,000 volt potential transformers and cabinet, and between cabinet and underground conduits. It speeded installation materially. **3** Connecting automatic forced air cooling to 15,000 Kva transformer bank, Sealtite absorbs movement set up by vibration of the equipment. No cracked or damaged conduit here!

"Sealtite solves a lot of problems at substations"

reports Mr. Leon Wheaton, construction and maintenance foreman, New York State Electric & Gas Corporation

"It's twice as fast to install as rigid conduit—and it really stands up under heat, wind, rain, snow and ice."

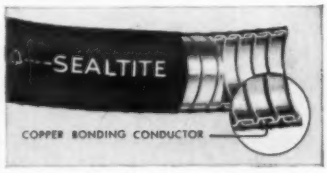
Sealtite* flexible, liquid-tight conduit resists the weather and corrosive conditions that often knock out ordinary metal conduit. Wiring can't be damaged. Protection is complete. That's one reason more and more utilities across the country are using this unique conduit in plants and substations.

Also—flexible Sealtite saves the time and expense of planning, cutting, cornering and fitting rigid conduit. Installations are faster. Sealtite takes up movement, vibration . . . makes a neat appearance . . . facilitates the replacement of motors and other equipment.

WHERE TO GET SEALTITE — Electrical Wholesalers stock Types U.A. and E.F.† Sealtite in easy-to-handle coils, in black or gray. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths on reels or in cartons and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors. Free Booklet S-538 gives full information on Sealtite. Write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. Sealtite is approved by Canadian Standards Association.

*Trademark †Pat. Applied For 57182

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.



Insist on the conduit marked

SEALTITE

flexible, liquid-tight conduit

an ANACONDA® product

PYLE *star-line*® CONNECTORS

Assure long-lasting protection of vital connections under a wide range of extreme environmental conditions

Currently establishing itself as a performance leader in the missile systems field, Pyle-Star-Line connectors offer engineers an entirely new line of electrical connectors for universal military and industrial use.

With characteristics of construction and performance never before combined in compact, rugged, lightweight standardized connectors, they exceed NEC requirements and classes A, B, C and E of military specifications MIL C-5015C.

FEATURES

Tough, lightweight shell: Strength comparable to mild steel, yet weighs only ⅓ as much.
Anodic coating: Gives shell toughness of case-hardened steel. Takes up to 1800 volts to penetrate coating.
"Sandwich" insulation: Silicone laminate floats between two rigid discs. Silicone disc absorbs shock, lets contacts align themselves freely; rigid discs impart just the right amount of restraint. Gives all advantages of both flexible and rigid mountings.
Chamber sealing: Silicone insulation disc positively and completely prevents water, gas, moisture or dust from passing into shell.
Wide range of pin and socket configurations: Configurations from 2 to 100 poles available. Within each form size all inserts are interchangeable and reversible.

Environmental Limits of Pyle-Star-Line connectors	
Temperature	—80 F. to 225 F.
Pressure	300 PSI External, 200 PSI Internal
Chemical Resistance	Most acids, most alkalis, oil
Corrosion Resistance	Salt Spray: 300 days without failure
Dust Resistance	Exceed requirements of MIL C-5015C
Shock Resistance	50G Minimum
Vibration	Exceed 20G to Method II of Mil C-5015C
Humidity & Moisture Resistance	Exceed Class E. Spec. of Mil C-5015C
Air Leakage	Meet Class E Spec. of Mil C-5015C

Write today for complete specifications.

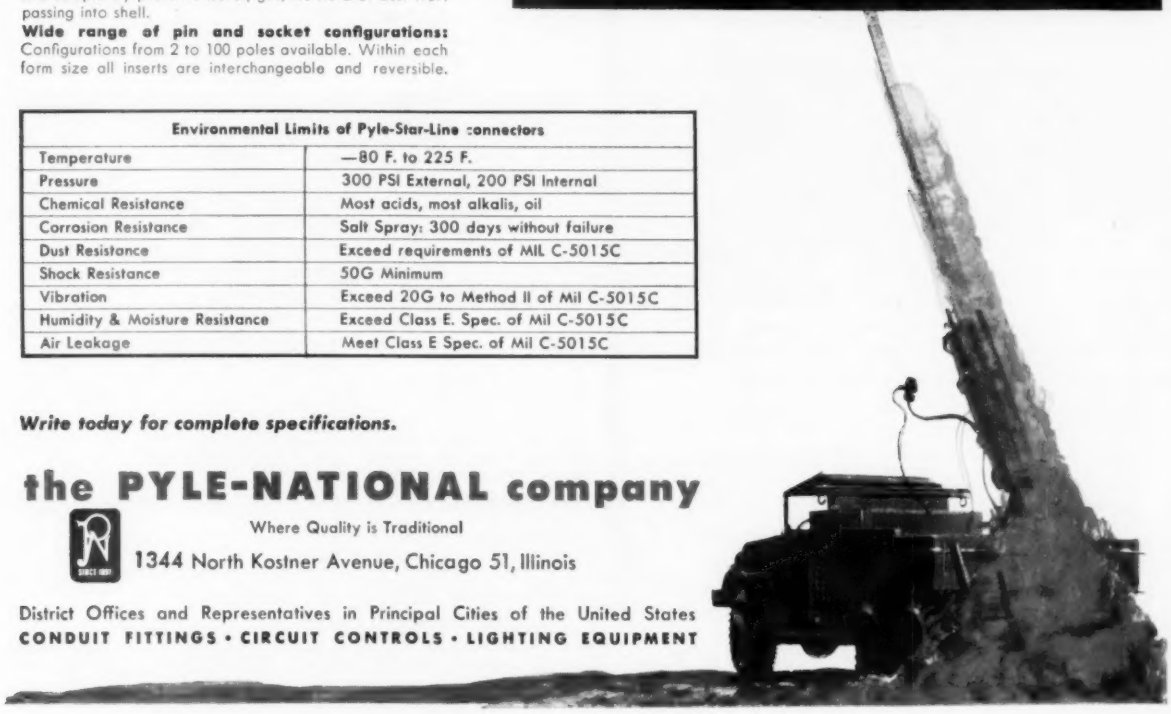
the PYLE-NATIONAL company

Where Quality is Traditional

1344 North Kostner Avenue, Chicago 51, Illinois

District Offices and Representatives in Principal Cities of the United States

CONDUIT FITTINGS • CIRCUIT CONTROLS • LIGHTING EQUIPMENT



Fast, uniform heat dialed to your exact need with CHROMALOX® Electric Far-Infrared

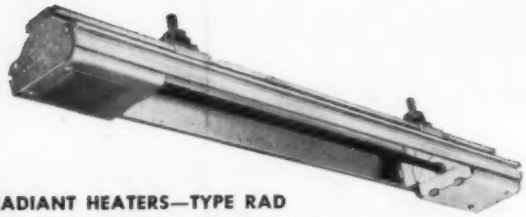
Here are four quickly available, easily installed ways to end production delays, irregular product quality and other common problems caused by inadequate heat sources. With Chromalox Electric Far-Infrared, you get uniformly distributed heat at the right temperature for the work. No more stand-by losses, leaking lines, smoke, fumes or flames. It's cooler and cleaner for your workers, too.

Chromalox Electric Far-Infrared radiation is absorbed uniformly by practically all colors, even by transparent materials. Elements are self-cleaning and maintenance costs are a bare minimum. All-metal heaters are practically indestructible. With no need for stand-by heat and since heat is generated where used, all energy is utilized.

To get more information, call your Chromalox Representative or write us direct for the Bulletins listed. In addition, if you will tell us your problem, we will send you a case history of an identical or similar application.

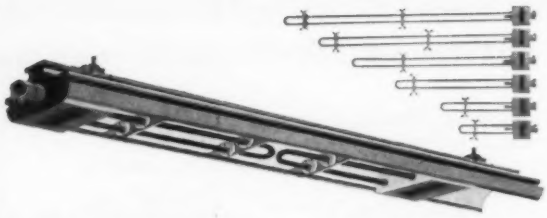
With Chromalox Electric Far-Infrared, you benefit in all these operations:

Annealing • Calendering • Curing Degreasing • Dehydrating • Drying Embossing • Food processing • Forming Fusing • Heat sealing • Laminating Molding • Paint baking • Planishing Polishing • Resin finishing • Setting coatings • Shrink fitting • Weld preheating.



RADIANT HEATERS—TYPE RAD

For single assembly or in banks. Two bolts in sliding clamps facilitate mounting; two wires to connect. Six standard lengths, 14 standard wattages. Housing is rigid extruded aluminum with brightly polished parabolic non-oxidizing reflector. Write for Bulletin CS-604.

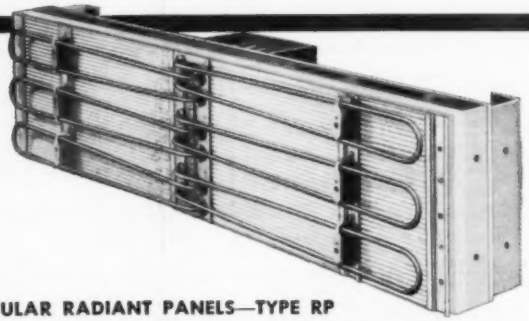


ADJUSTABLE AREA RADIANT HEATERS—TYPE U-RAD

Lets you match heat area to work area. Choose one basic housing to match your largest work. Into this housing install any of 6 different heaters to get up to 27 heated lengths as job sizes change. Bulletin CS-607

METARAY® LAMP REPLACERS—TYPE FRB

Now any infra-red reflector bank can be equipped with glassless, glareless, self-cleaning Metaray elements. Radiation is spread more uniformly from the larger element configuration. Write for Bulletin L-1104.



MODULAR RADIANT PANELS—TYPE RP

A high-intensity heat source in four standard sizes. Modular panels completely factory assembled with built-in continuous bus, reflector, insulation, frame and mounting. Lets you tailor heat source exactly to process requirements. Write for Bulletin CS-606.

THE RIGHT HEAT, EASILY DUPLICATED AT THE TURN OF A DIAL

Inexpensive, automatic input controllers provide accurate temperatures. As required by different work, heater input can be set anywhere from 4 to 100% of capacity. Better control, combined with better distribution, give more uniform product quality and higher production.

CHROMALOX — FIRST NAME IN ELECTRIC HEAT

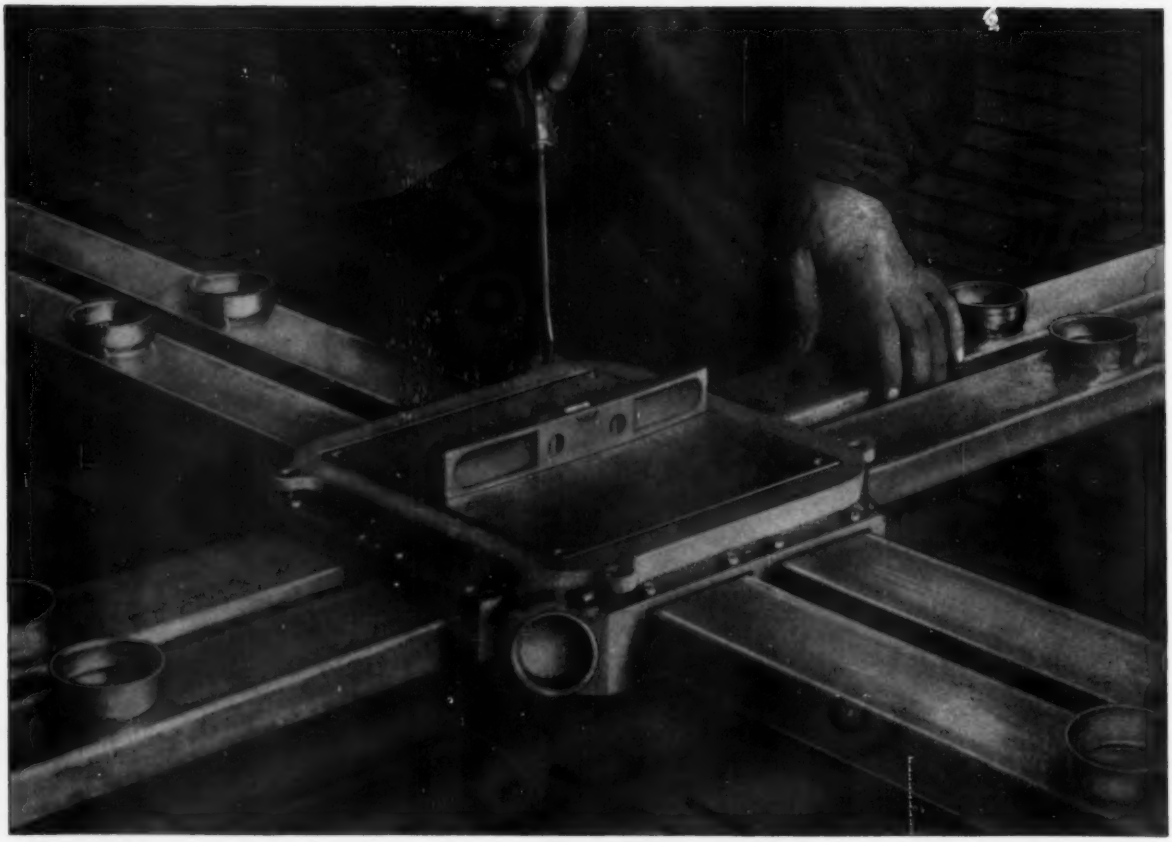
Edwin L. Wiegand Company

7637 Thomas Boulevard • Pittsburgh 8, Pa.

C-2121

CAROL CABLE COMPANY • Division of the Crescent Company, Inc., Pawtucket, R.I.

• Portable Cords • Cordsets • Lamp Cords • Welding Cables • Thermostat Wires • Power Supply Cables



Spang-Howarduct underfloor raceway for commercial and industrial installations carries wiring for electrical, telephone and signal systems. Outlets every 24 inches give abundant service, permit future office or machinery rearranging without expensive rewiring.

HOWARDUCT UNDERFLOOR RACEWAYS NOW A SPANG ELECTRICAL PRODUCT

Now—Howarduct Underfloor Raceway Systems are a part of the Spang electrical products line. And this means good things for you:

1. AN IMPROVED RACEWAY

Spang's years of diversified engineering and manufacturing experience now go into the production of Spang-Howarduct Raceways. Many product improvements have already been made to provide you with the best underfloor raceway on the market.

2. YOUR CHOICE OF 3 SYSTEMS

Standard duct for conventional installations . . .

Industrial duct for manufacturing plants . . .

Headerduct for use with cellular-type floor construction.

3. TOP-QUALITY FITTINGS

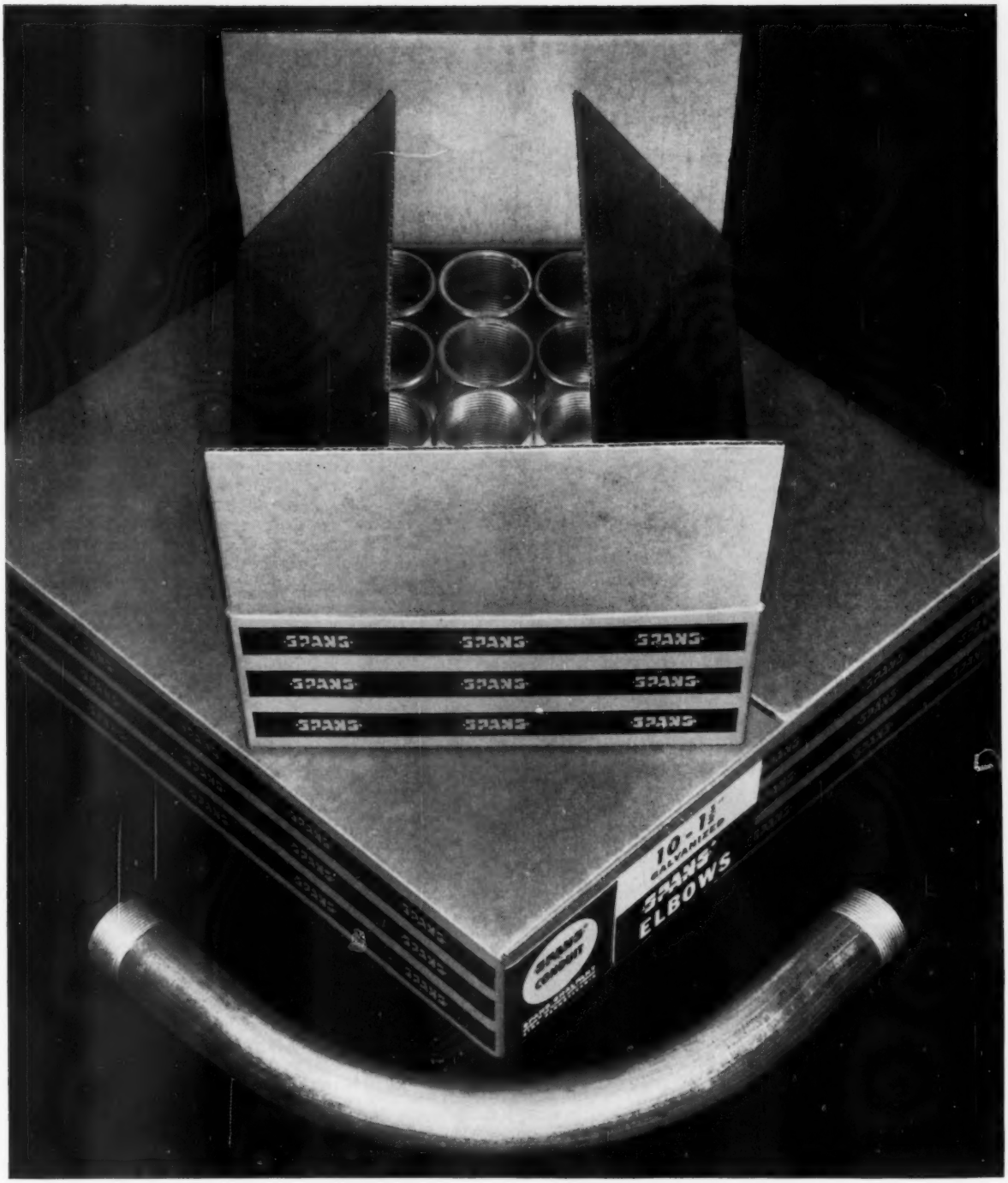
A complete line of outlet fittings . . . available in brushed brass or aluminum finish. Recognized by architects, engineers and electrical contractors to be best in design and appearance.

Want more information? You'll like working with new Spang-Howarduct; it's a top-quality raceway. Write for complete details.

SPANG-HOWARDUCT

Division of The National Supply Company

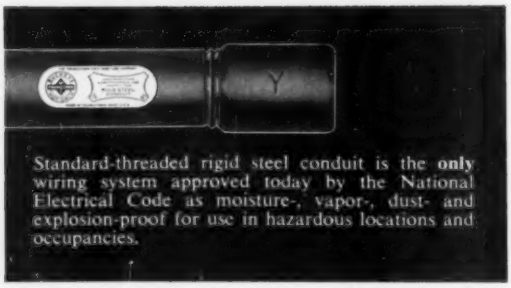
2 Gateway Center, Pittsburgh 22, Penna.



Your shipments of SPANG Conduit Couplings and Elbows now come in these newly-designed blue-striped cartons. Why the change? The high visibility of the new cartons and labels make it easier for you to spot them in a hurry, easier to pick out of stock what you need when you need it, easier to inventory. Inside—the same *top-quality* SPANG Couplings and Elbows you've been using right along. Your nearby SPANG Distributor carries the complete line of SPANG Couplings and Elbows in the new cartons . . . and SPANG Conduit and SPANGLEAM EMT, too. He'll give you *top-quality* service. Give him a call.

SPANG® CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
TWO GATEWAY CENTER, PITTSBURGH, PA.
District Offices and Sales Representatives in Principal Cities



Standard-threaded rigid steel conduit is the **only** wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.

YOUNGSTOWN "BUCKEYE" CONDUIT

. . . gives life-time wiring protection to Zanesville's Good Samaritan Hospital

Good Samaritan Hospital
Zanesville, Ohio

Architect: Dan A. Carmichael, Columbus, Ohio
General Contractor: Knowlton Construction Company, Bellefontaine, Ohio
Electrical Contractor: Electrical Contractors, Inc., Columbus, Ohio

Failure of its all-important electrical system will never interrupt the smooth operation of the Good Samaritan Hospital in Zanesville, Ohio. That's because the builder of this well known institution wisely specified Youngstown's Full Weight Rigid Steel "Buckeye" Conduit for protection of the wiring system from damaging elements such as water, moisture, vapor, dust and dirt.

If the proper functioning of **your** electrical wiring systems—in any location, under any condition—presents a problem, then Youngstown "Buckeye" Conduit should be your specification. Reports from across-the-nation tell us, "It's easier to bend and thread, wire fishing is faster and easier—and its superior corrosion-resistance gives a much longer service life after installation"

Remember, Youngstown is the only producer of rigid steel conduit that controls all its integrated operations from ore mine to finish threading. Thus, you can be sure each length is of the same high quality that has made "Buckeye" Conduit the accepted standard of leading owners, architects and contractors everywhere.

Delivery is no problem—because all leading industrial and electrical distributors carry complete and ample stocks. Why not call today for quick and efficient handling of your current requirements.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

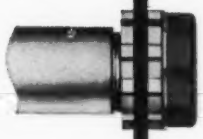
INSULATED CONNECTORS

THE NEW CONCEPT IN FITTINGS THAT REDUCES WIRE PULLING EFFORT UP TO 50%

Insulating Bushing

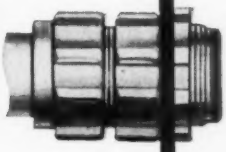
Insulated Metallic Bushing*

Insulated Chase Nipple



STANDARD RIGID CONDUIT

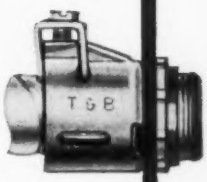
Insulated EMT Connector



ELECTRICAL METALLIC TUBING

Insulated Tite-Bite Connector — straight

Insulated Tite-Bite Connector — 90°



FLEXIBLE CONDUIT OR ARMORED CABLE

*available soon

Look for the bright blue insulation

ANOTHER NEW T&B ENGINEERED EXCLUSIVE —
The First Line of Self-Insulated Raceway Fittings! Just look at the many benefits you get with these new "insulined" fittings.

They are the *EASIEST* to Install

Factory-assembled, the Insuliner is a permanent part of the fitting — it can never come loose or pull out. The slippery insulined throat cuts pulling effort by as much as 50%.

They make the *SAFEST* Installation

Because of the nationwide accent on safety, the trend is toward insulated fittings in all locations. Insulated bushings are standard fittings today. Extremely tough they are unaffected by common acids, solvents, moisture or fumes.

They make the *MOST ECONOMICAL* Installation

A one-piece fitting makes installation fast and easy for maximum on-the-job savings. There is no need to add a separate insulating bushing.

They give the Installation a *QUALITY LOOK*

Strong, longer bodies and heavy lock nuts . . . 100% visibility . . . accurate threading . . . all of the features you've come to expect in a T&B engineered fitting.

Write for free samples and technical data or contact your nearby T&B Distributor.

LOOK FOR THIS SIGN —

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T&B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T58

All T&B insuline fittings bear Underwriters Laboratories Approval

THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada
MANUFACTURERS OF QUALITY ELECTRICAL FITTINGS SINCE 1898

HEADING UP A PARADE OF NEW STAB-LOK ADVANCES...

The Most Complete 3-Pole

*3-POLE DELTA BREAKER

Breaker Line on the Market

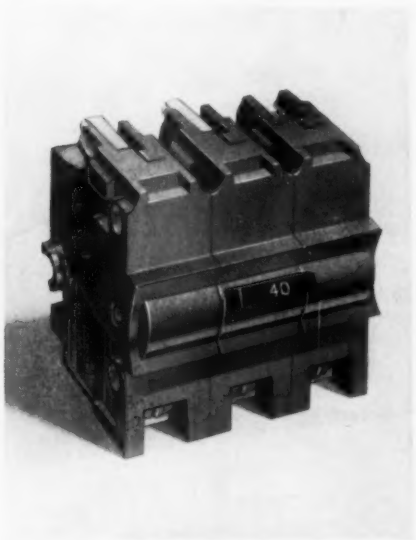
...ratings from 15 through 70 amperes!

Now it's the most complete 3-pole breaker line within its frame size – but even this is only the beginning! Its range of ratings is earmarked for even greater expansion to give you a 3-pole breaker line unmatched anywhere for its completeness. Using the millions-tested Stab-lok metal heart, this new breaker brings to 3-pole applications the dependability that has made Stab-lok the most widely used circuit breaker in the world.

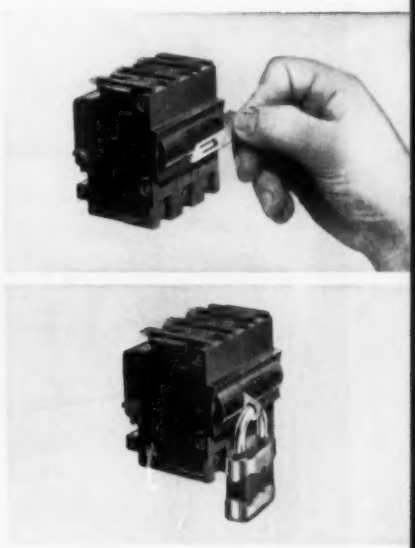
Equipped with "single-handle" operation normally found only on the most expensive molded case breakers – the new 3-pole Stab-lok circuit breaker can be plugged into any 3-phase, sequenced-bussed loadcenter or NALP Panelboard.

FOR 3-PHASE MOTOR CIRCUIT APPLICATIONS:

FOR USE IN NALP LIGHTING AND POWER PANELBOARDS–3-pole Stab-lok makes it possible to use inexpensive Stab-lok loadcenters (NS412 or NS418) or NALP Panelboards as power panels or combination power and lighting panels for 3-phase or 3-phase, 4-wire applications.



NEW 3-POLE DELTA BREAKER – Specifically designed for 3-phase, 4-wire Delta applications where a 3-phase motor circuit is required. This new Breaker now makes it possible to combine 3-phase motor and lighting loads in a standard "dual-rated" Stab-lok single-phase panel. Rated from 15 through 40 amps, 240 v. A.C.



EXCLUSIVE "SNAP-IN" LOCKING HASP – To comply with codes requiring provisions for locking a motor circuit, the new 3-pole Stab-lok breaker brings you the first "snap-in" type hasp ever developed for this purpose. This unique method of locking can also be used for sealing or for a "lock-on" screw when used on clock circuits.

For complete details, write:

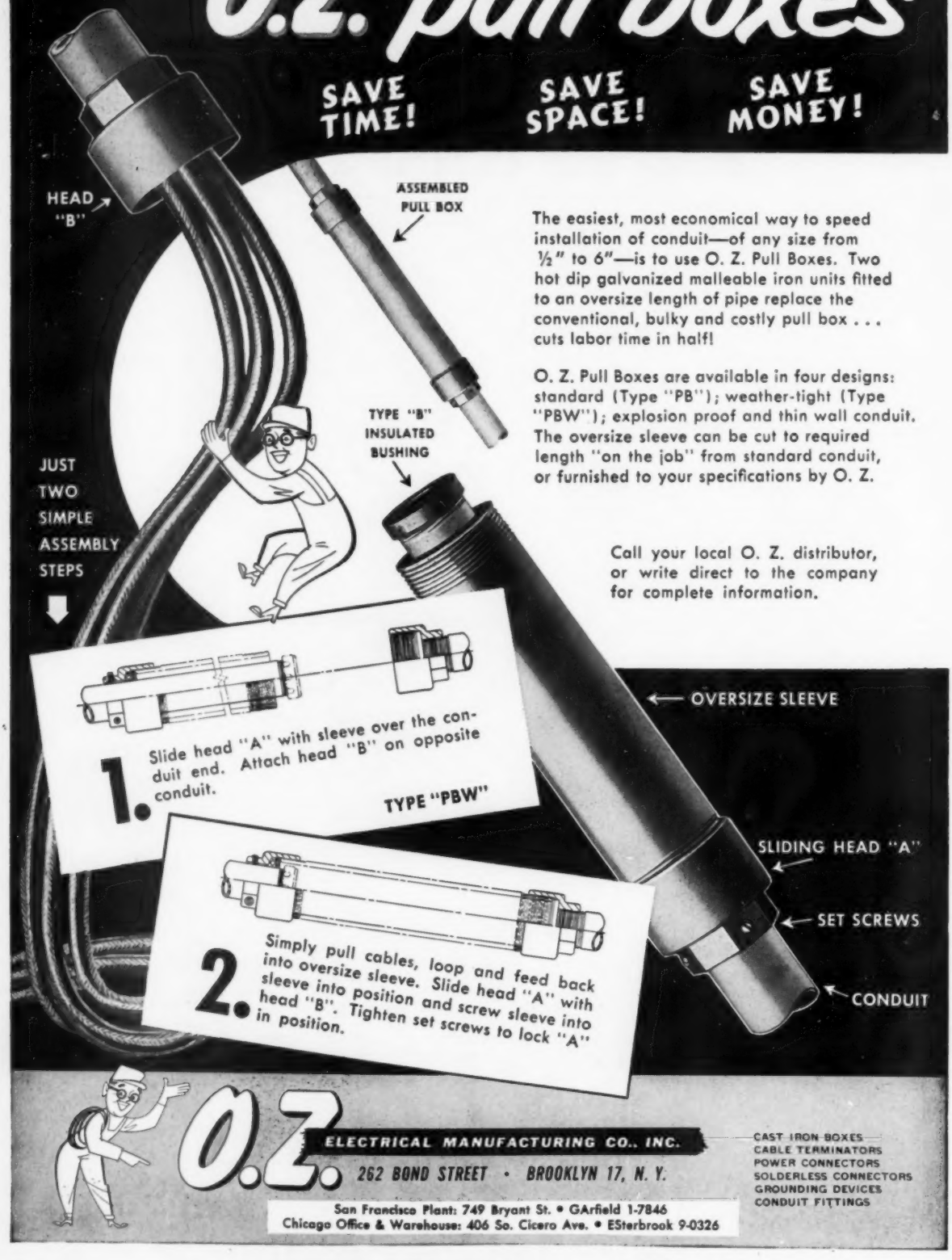
Federal Pacific Electric Company, 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

O.Z. pull boxes

SAVE TIME! SAVE SPACE! SAVE MONEY!



The easiest, most economical way to speed installation of conduit—of any size from ½" to 6"—is to use O. Z. Pull Boxes. Two hot dip galvanized malleable iron units fitted to an oversize length of pipe replace the conventional, bulky and costly pull box . . . cuts labor time in half!

O. Z. Pull Boxes are available in four designs: standard (Type "PB"); weather-tight (Type "PBW"); explosion proof and thin wall conduit. The oversize sleeve can be cut to required length "on the job" from standard conduit, or furnished to your specifications by O. Z.

Call your local O. Z. distributor, or write direct to the company for complete information.

1. Slide head "A" with sleeve over the conduit end. Attach head "B" on opposite conduit.

TYPE "PBW"

2. Simply pull cables, loop and feed back into oversize sleeve. Slide head "A" with sleeve into position and screw sleeve into head "B". Tighten set screws to lock "A" in position.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

San Francisco Plant: 749 Bryant St. • GArfield 1-7846
Chicago Office & Warehouse: 406 So. Cicero Ave. • ESterbrook 9-0326

CAST IRON BOXES
CABLE TERMINATORS
POWER CONNECTORS
SOLDERLESS CONNECTORS
GROUNDING DEVICES
CONDUIT FITTINGS

DUTCH BRAND PLASTIC ELECTRICAL TAPES

Thin, strong, flexible with unusual resistance to destructive elements. Three thicknesses: .007", .010", .020".

DUTCH BRAND VINYL COLOR TAPE

Nine colors, four widths for all insulating, coding, indexing. U. L. listed.

DUTCH BRAND RUBBER TAPE

The finest tape of its kind. Resists up to 18,000 volts through a single thickness.

DUTCH BRAND FRICTION TAPE

An industry favorite for over 40 years. For perfect adhesion, for longest life choose Dutch Brand.

Get the Best...
ask for Dutch Brand

... Using the Finest Electrical Tape

...Dutch Brand

Throughout industry Dutch Brand Tapes have earned the top reputation. Why? Because they are made to do the best job. They start with the finest raw materials and process them at every step with the greatest care and skill. The result is a finished product that exceeds the specifications and standards of the industry. Ask your suppliers for Dutch Brand. You are paying for the best—so be sure you're getting it.

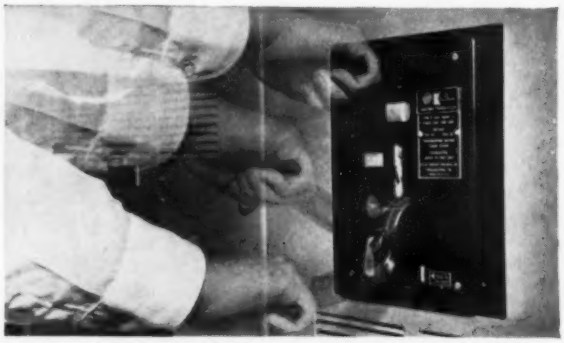
JOHNS-MANVILLE
JM
PRODUCTS

JOHNS-MANVILLE

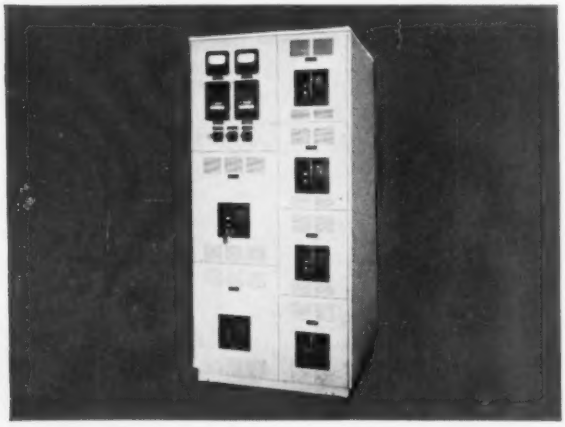
I-T-E makes sweeping design advances in new low voltage power circuit breakers, switchgear

I-T-E's new K-Line offers better performance, greatly simplified operation and servicing, and standardization in construction and assembly

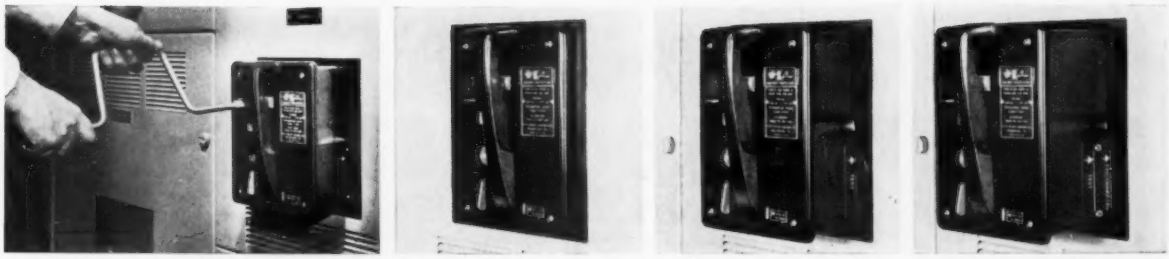
Now we offer a complete new design of equipment for the switching, control and protection of motor, generator, transformer and feeder circuits, as well as other large electrically powered facilities—the most sweeping design advance in 13 years. Among the major innovations in the new design are the following.



First quick-make manually charged stored energy closing mechanism. First 90% of pulldown handle travel charges spring mechanism, last 10% releases stored energy, automatically closes contacts. No teasing of contacts is possible.

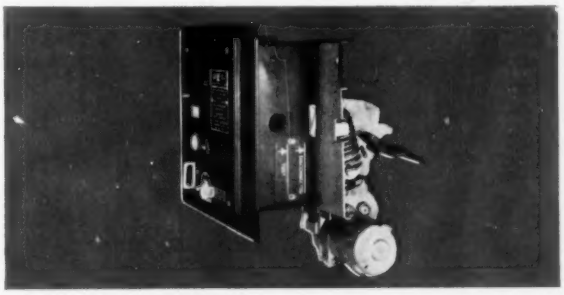


4-high stacking of 600 amp frame size circuit breakers in 90-in.-high enclosures. The new circuit breakers are as much as one-third smaller and 55% lighter than comparable units. The new switchgear is the smallest ever designed.

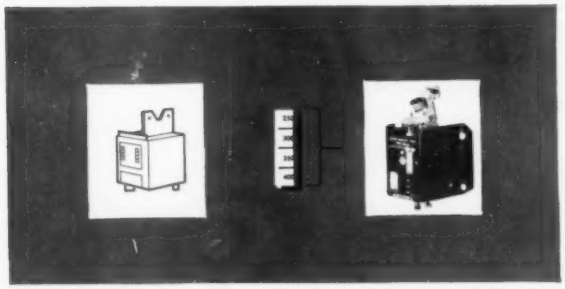


First closed-door drawout of circuit breakers. This permits racking of circuit breaker into connected, test and disconnected positions without opening the door of the circuit breaker compartment. Drawout arrangement keeps circuit breakers clean, aisles uncluttered, promotes personnel safety. Breaker must be opened before shutter can be lifted to insert drawout racking crank. Breaker cannot be closed while shutter is lifted.

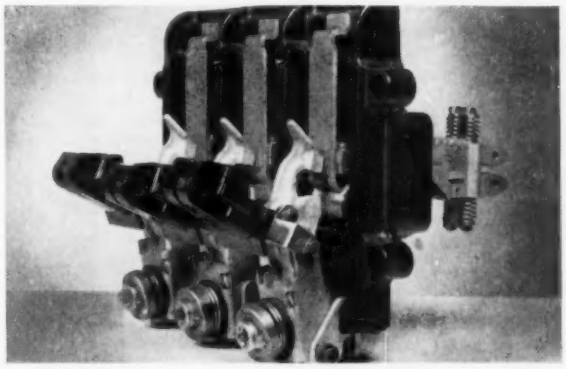
Greatly increased accessibility to component parts for operation and servicing. For example, trips on electrically and manually operated breakers are out in the open and can be easily adjusted. Trips also can be changed quickly. One-piece molding holds trip units, which are changed from the rear and in a fraction of the time formerly required.



Stored energy electrical closure that materially cuts control circuit requirements. The motor-driven stored energy system requires only 10 amp from a simple power source, compared to as much as 160 by comparable solenoids. Quick-make manual closure operates on same principle. First 90% of pull-down handle travel charges a spring mechanism. Last 10% releases the stored energy and closes the contacts. No teasing.



Expanded trip flexibility meets last-minute load changes in many instances with the existing trip unit.



Subassembly circuit breaker construction permits easier, faster replacement of parts. Six major subassemblies replace 130 separate parts in previous models. A part replacement formerly requiring an all-day overhaul of the circuit breaker may mean only removing and replacing a unit subassembly—a matter of minutes.

Bulletin 6004C tells the complete story of this advanced design switchgear. Ask your local I-T-E representative for a copy today. Or write I-T-E CIRCUIT BREAKER COMPANY, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STREETS, PHILADELPHIA 30, PENNSYLVANIA

Here's Why...

Silicone Insulated Motors Help Keep Production Moving

When the heat's on production and machines are pushed to rated capacity and beyond, motors get hot too. That's when it pays to have drive motors and essential auxiliary motors insulated with heat stable Dow Corning silicone insulation.

Silicone insulation withstands temporary overloads that burn out other insulation. Insulated with silicones, motors keep going even when pushed 50% above rated capacity, practically eliminating the most frequent cause of work stoppages.

If your plant is automated or has continuous processing lines you can rely on motors insulated with Dow Corning Silicones to keep production moving ahead.

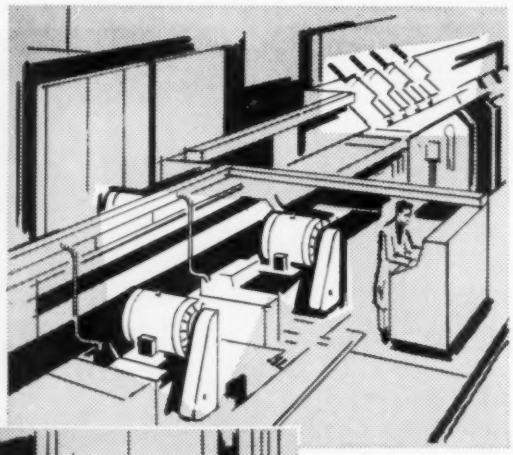
What's more, you can count on reliable motor performance despite high ambients, moisture, plugging, rapid reversing or corrosive atmospheres.

Leading motor builders now offer motors insulated with Dow Corning Silicones. Both ac and dc motors, silicone-insulated for longer insulation life, are available in standard frame sizes.

For maximum reliability and to keep production moving despite the heat of temporary overloads—

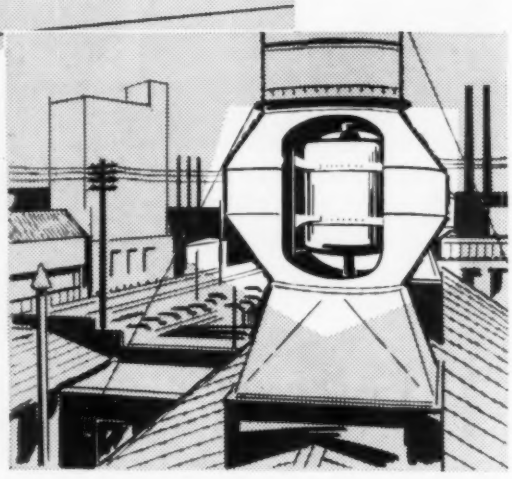
Specify DOW CORNING SILICONES and *Save*

Write Dept. 392 for list of builders who offer Dow Corning silicone-insulated motors.



On production set-ups, where downtime is measured in lost profits, silicone-insulated motors keep going despite overloads.

In continuous processing, fluid handling equipment stays "on stream" despite moisture, overloads and high ambient temperatures.



Silicones add reliability to essential auxiliary drive motors. This cupola exhaust fan motor is cooled by oven-hot air.

first in silicones

Dow Corning CORPORATION

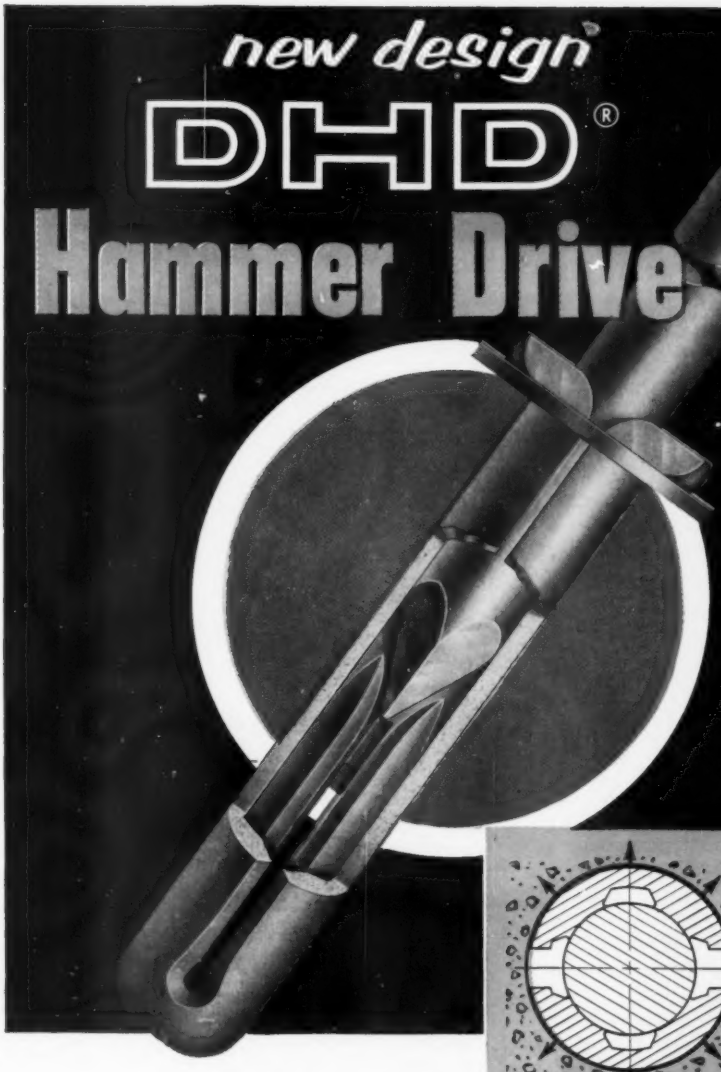
MIDLAND, MICHIGAN

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS
DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C.

new design

DHD®

Hammer Drive Anchors

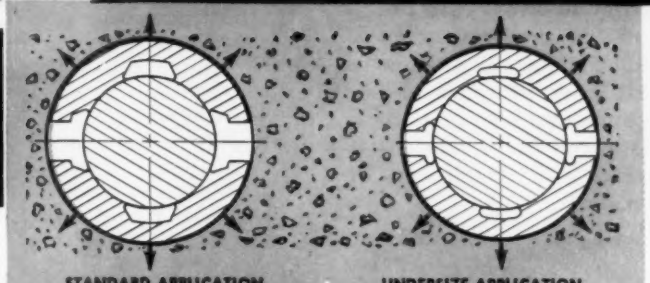


are easier to drive ...hold more weight

The DIAMOND DHD Hammer Drive Anchor, standard masonry fastener for the telephone and utility fields for nearly 30 years, has now been greatly improved with a newly engineered design, featuring

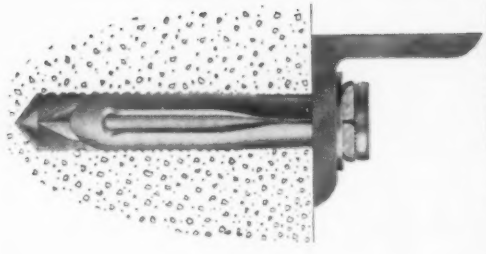
Internal Ribbed Construction

The addition of these ribs provide variable radial expansion for tight fit regardless of variation in hole size, developing the greatest *sustained* holding power ever possible. Aluminum anchor and hot dipped galvanized nail — a completely rust-proof anchoring unit.



STANDARD APPLICATION
Pressure of nail against ribs expands shield outward forming a tight, secure fit in hole.

UNDERSIZE APPLICATION
Wedging action of nail against ribs flattens them around nail shank as they transmit pressure outward. Grip is firm and positive. Hammer it home and it stays put.



Metal Won't "Creep"

Special aluminum alloy shield can't "creep". Because of this, the DHD Anchor withstands amazingly high sustained loads. DIAMOND also supplies a complete line of masonry drills and accessories. All products are sold through qualified distributors. Call or write for information today.

DIAMOND EXPANSION BOLT CO., INC.
500 North Avenue • Garwood, New Jersey

Stocking Warehouses: Atlanta, Boston, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington, D. C. Also, Montreal, Toronto and Vancouver, Canada.

4858

Regulate and control electric power

for any manufacturing process

better, accurately, efficiently, with

Sorgel saturable reactors

The control can be a small, manually operated, stepless adjusting auto transformer which can be placed in any desirable location, or it can be automatic.

Available in ratings of 1 Kva to 1000 Kva single phase. 3 to 3000 Kva poly-phase. All voltages up to 15,000 volts.

Sorgel reactors are designed to meet your exact requirements. Let us know what your problems and requirements are, and we will submit our recommendations with complete information.

Sales engineers in principal cities

●

Also a complete line of dry-type transformers

¼ Kva to 2500 Kva single phase.
1 Kva to 3000 Kva poly-phase.
All voltages 120 to 15,000 volts.

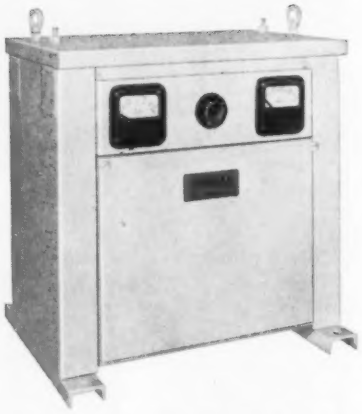
●

Substations

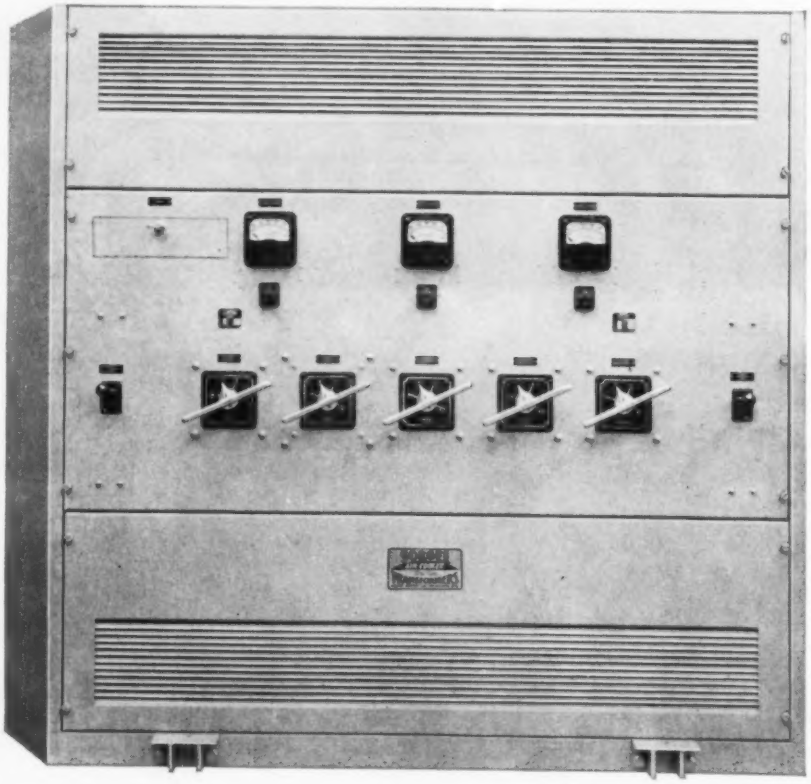
Sorgel transformers, either dry-type or Askarel-cooled, are incorporated in substations, complete with primary or secondary switchgear. They are procurable with any type or make of switchgear, and from any substation manufacturer.

Some typical applications:

Electric ovens.
Electric furnaces.
Electric heat treating equipment.
Glass melting equipment.
Metal melting equipment.
Dimmers for incandescent and infra-red lamps.
Variable speed motors.
Chemical processing.



15 Kva, single phase, 60 cycle Saturable Reactor with voltmeter, ammeter, D.C. supply and manual control.



470 Kva, three phase, saturable reactor — Transformer combination with circuit breakers and metering. Tap switches on transformer and reactor provide controlled load voltage in six ranges.

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wisconsin

There's *no* equal for this time, trouble and money-saving receptacle! Just seconds to wire... and one hand split-second wire release without special tools! Exclusive * Slater patent instant side release leaves wires straight and clean for immediate rewiring.

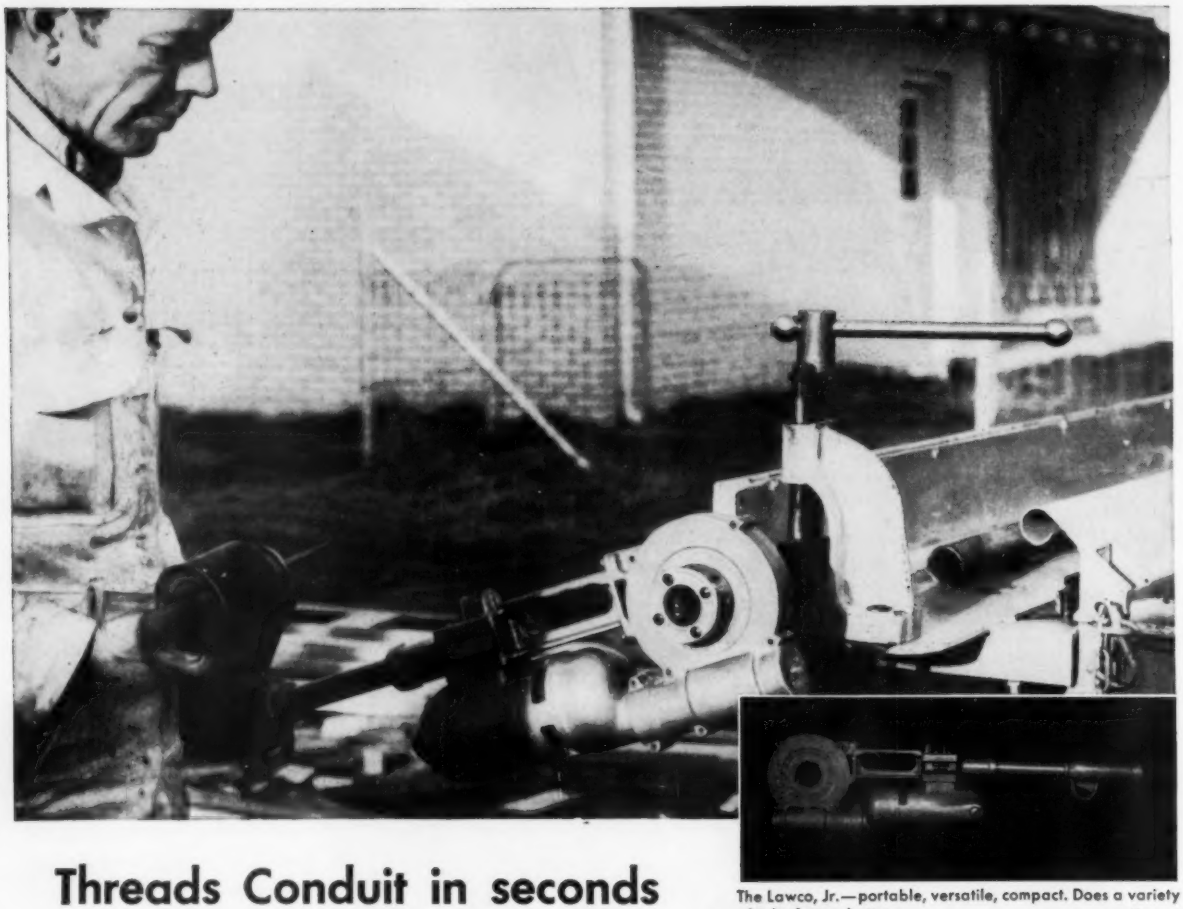
ASK FOR SLATER AND BE SURE YOU GET SLATER...THE FINEST WIRING DEVICES ON THE MARKET TODAY. *Write for Slater Catalog.*

* PAT. 2,795,677

Slater

Lifetime Wiring Devices

SEA CLIFF AVENUE, GLEN COVE, NEW YORK • ORIOLE 6-1100



The Lawco, Jr.—portable, versatile, compact. Does a variety of jobs faster, better.

Threads Conduit in seconds

...the Lawco, Jr.

PORTABLE PIPE THREADER

Here's the answer to those slow, tiring, hand-threading jobs. The Lawco, Jr. Portable Pipe Threader does the work in seconds. This modern portable power tool threads the smallest to the largest conduit. Simple adapters and speed reducers handle pipe from ¼-inch to 6".

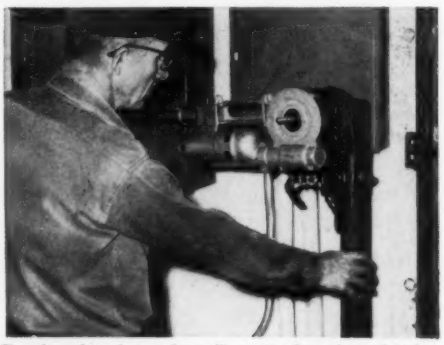
Its operation is simple. Just position Lawco, Jr. on the conduit, press the trigger, and the power unit drives the cutting dies. You're finished in no time, and right at the location where you are installing the conduit.

And Lawco, Jr. comes in handy for other jobs, too. Several are illustrated at the right. In addition to these applications, you can use your Lawco, Jr. for driving nuts and bolts, and hoisting weights up to 500 pounds.

This light weight (20 lbs.) tool is precision built for years of service. Write for details.

Augering operation with Lawco, Jr. Efficient in vertical or horizontal operations.

Post hole application using square shank. Lawco, Jr. does it faster.

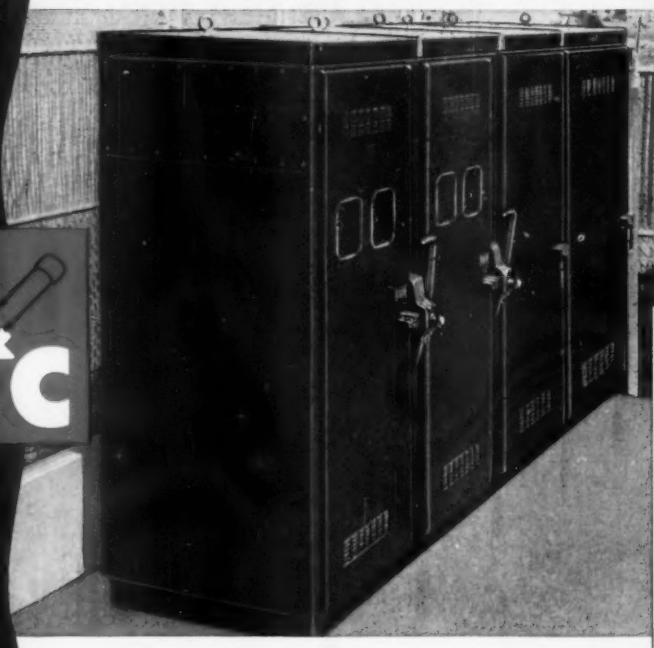


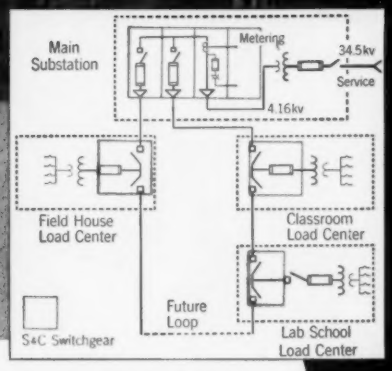
There's nothing better for pulling wire through conduit than the Lawco, Jr. The unit's portable feature speeds work.

VELOCITY POWER TOOL CO.

201 North Braddock Avenue, Pittsburgh 8, Pa.

For your high-voltage power circuits–





S&C Metalclad Switchgear at Northern Illinois University's main substation, DeKalb, Illinois. Resident Architect: Kenneth Thelen; Consulting Engineer: S. W. Knetsch & Associates, DeKalb; Electrical Contractor: Virgil Cook & Sons. The unit shown is the main substation secondary gear. Three other S&C units (see one-line diagram) serve as the primary switchgear for the three load centers.

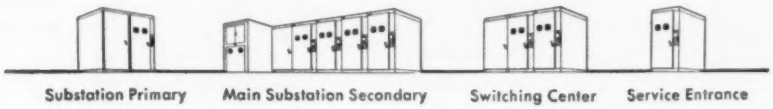
Buy the right protection in your switchgear . . . buy S&C metalclad switchgear . . . save 50%

Institutional and industrial high-voltage power circuits, such as that shown here, do not have transient faults. They cannot be re-energized immediately following an outage. Thus the use of costly circuit breakers is unnecessary. The right protective devices for such circuits are S&C Power Fuses.

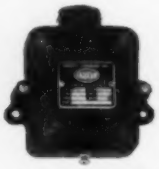
For such high-voltage power circuits, conductors run in cables or conduits. They are not exposed to lightning, falling trees, rodents, wind, or ice which cause transient faults on overhead circuits typical of electric utilities.

Consequently, the only faults that occur are permanent faults, and S&C Power Fuses give the right protection against them. The quick reclosing feature of expensive circuit breakers is of no value here. S&C Metalclad Switchgear—by using S&C Power Fuses rather than circuit breakers and by incorporating load interrupters for full load switching—brings a substantial savings in switchgear costs, sometimes as much as 50%.

S&C Electric Company, 4433 Ravenswood Ave., Chicago 40, Ill.
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.



VIBRATING BELLS
Cat. No. 2000



AC "CM" BUZZER
Cat. No. 284 MI

AC UNI-PACT HORNS
Cat. No. 123-U Two-Way Projector

AC UNI-PACT HORNS
Cat. No. 121-U Megaphone Projector

AC "CM" HORNS
Cat. No. 128-S

AC "CM" VIBRATING BELLS
Cat. No. ATL-700

DC BUZZER
Cat. No. 101

Compressor Type
AIR TRUMPETS
Cat. No. 109-DC
Cat. No. 110-AC

UTILITY CHIME
Cat. No. 1531

KODE MASTER
for Coded Paging Systems
Cat. No. 805

AC WEATHERPROOF
KODAIRE HORNS
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AC UNI-PACT
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IN SOUND AND SIGHT SIGNAL EQUIPMENT

More and More Architects Specify

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Sperti Faraday delivers the latest dependable developments in sound and sight communication systems for business, industry, school, hospital, home. From a simple buzzer to the amazing Visicall system that can revolutionize hospital care, it's new and it's dependable if it's Sperti Faraday.

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Since 1875 Designers and Producers of Visual and Audible Signals

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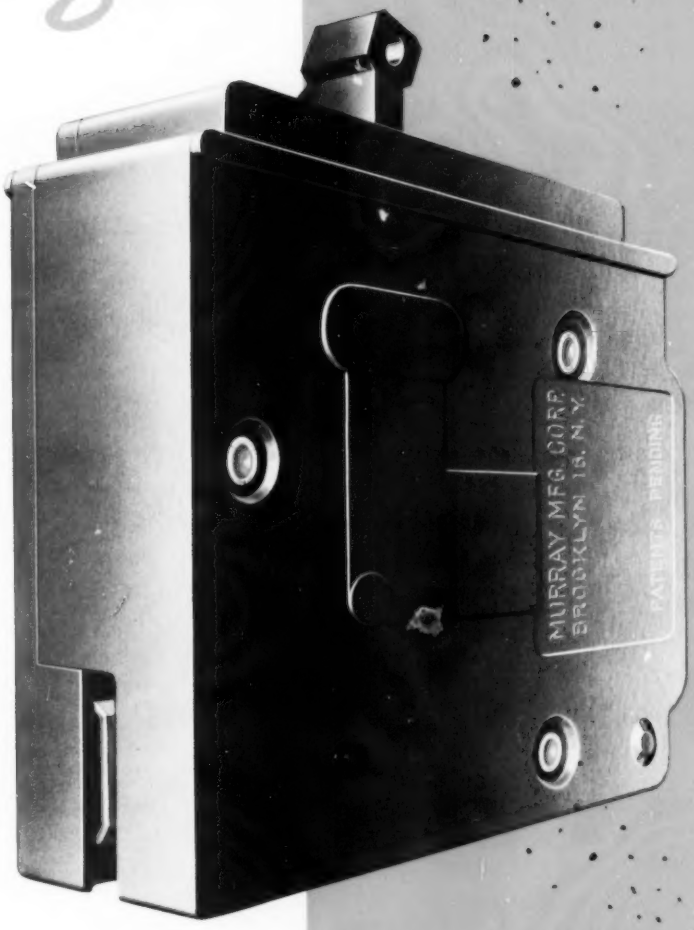
Offices in 36 principal cities in the U.S.A. and Canada

Announcing

the new Murray "MP" Circuit Breaker



never before such complete circuit protection in a competitively priced, plug-in type breaker

It's Fully Magnetic!

It's Competitively Priced!

It's Available Now!

MURRAY FULLY MAGNETIC "MP" PLUG-IN CIRCUIT BREAKER NOW AVAILABLE AT COMPETITIVE PRICES

Finally after years of development and engineering, comes a fully magnetic, competitively priced plug-in type breaker – the new Murray "MP."

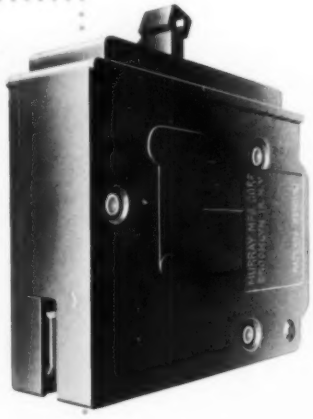
With all of the superior performance characteristics of the original Murray magnetic breaker, the new "MP" allows contractors to offer homeowner customers the best of circuit protection at no increase in cost.

Examine the *5-point circuit protection* offered by the "MP" – consider its many advantages – see why "MP" breakers are easier to sell for both wholesaler and contractor alike.

"MP" breakers are available now at your wholesaler's. Ask for them!

CHECK THESE FEATURES!

- Fully magnetic – unaffected by heat
- Complete protection **at all degrees** of overload
- No nuisance tripping
- No derating ever needed
- No waiting to reset
- Minimum callbacks – maximum profits



Stock up now

on "MP"

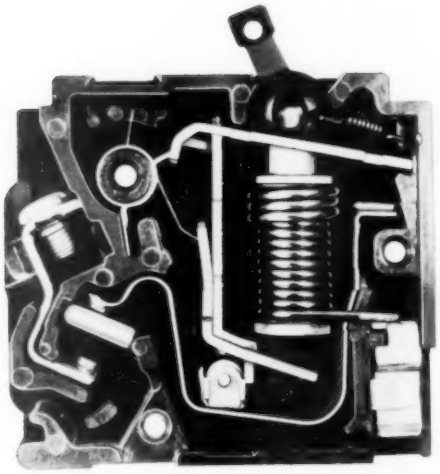
BREAKERS AND LOAD CENTERS –

For complete circuit protection at standard prices . . . it's the new "MP"!

Of all competitively priced, plug-in type breakers . . .

ONLY THE "MP" OFFERS THIS 5-POINT CIRCUIT PROTECTION

...AT NO EXTRA COST



Secret of the complete circuit protection provided by the "MP" breaker is the now famous "fully magnetic iron core."

The circuit protection installed by the contractor carries a serious responsibility. A man's life, his home, his family, his business . . . any one or all may depend on its proper performance.

To provide this kind of protection, a breaker must perform these five important functions:

1. **Carry full rated load at all times!** Since no thermal element is used in "MP" breakers, surrounding temperatures have absolutely no effect! Load centers can be mounted in most convenient spot while breakers can carry full rated load at all times without need for complex derating. See Chart A.

2. **Never trip unnecessarily!** Unlike temperature-sensitive thermal type breakers, the "MP" will not trip with the inrush load of additional appliances if the **normal** load of those appliances adds no more to the existing load than the wire can safely carry. See Chart B.

3. **Give positive action on moderate overloads!** Fully magnetic "MP" breakers are designed to give instantaneous circuit interruption at a sufficiently low current value (below 150 amperes) – thus providing the necessary protection for flexible cords. See Chart C.

4. **Act instantly on short circuits!** While breakers with thermal elements may carry dangerous overloads a bit too long for complete protection, "MP" breakers are designed to trip instantly at 10 times their rating . . . thus offering protection when it is most needed. See Chart C.

5. **Reset immediately without waiting!** Although not immediately apparent, delays usually encountered in trying to reset thermal type breakers after overload or short circuit can be annoying, even costly. "MP" breakers can be reclosed **immediately** and **will remain closed** with removal of dangerous condition. See Chart D.

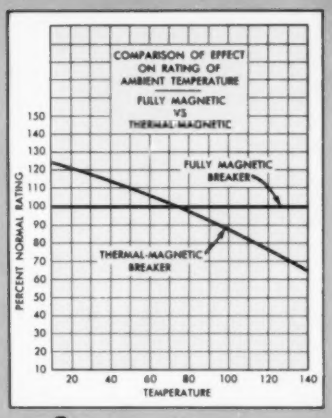


Chart **A**

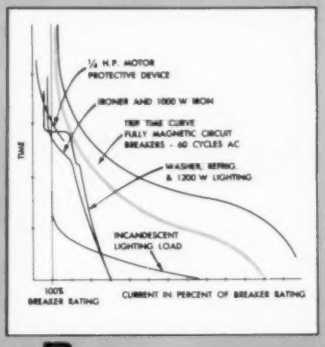

½ H.P. MOTOR PROTECTIVE DEVICE
IRONER AND 1000 W IRON
TRIP TIME CURVE FULLY MAGNETIC CIRCUIT BREAKERS - 60 CYCLES AC
WASHER, REFRIG. & 1200 W LIGHTING
INCANDESCENT LIGHTING LOAD
TIME
100% BREAKER RATING
CURRENT IN PERCENT OF BREAKER RATING

Chart **B**

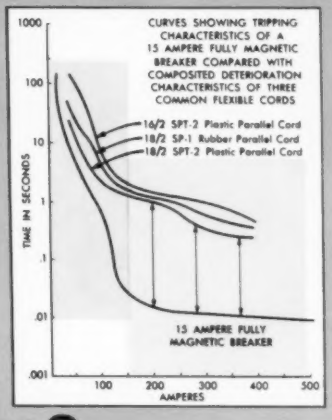


Chart **C**

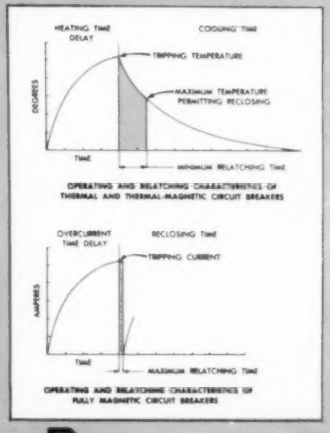
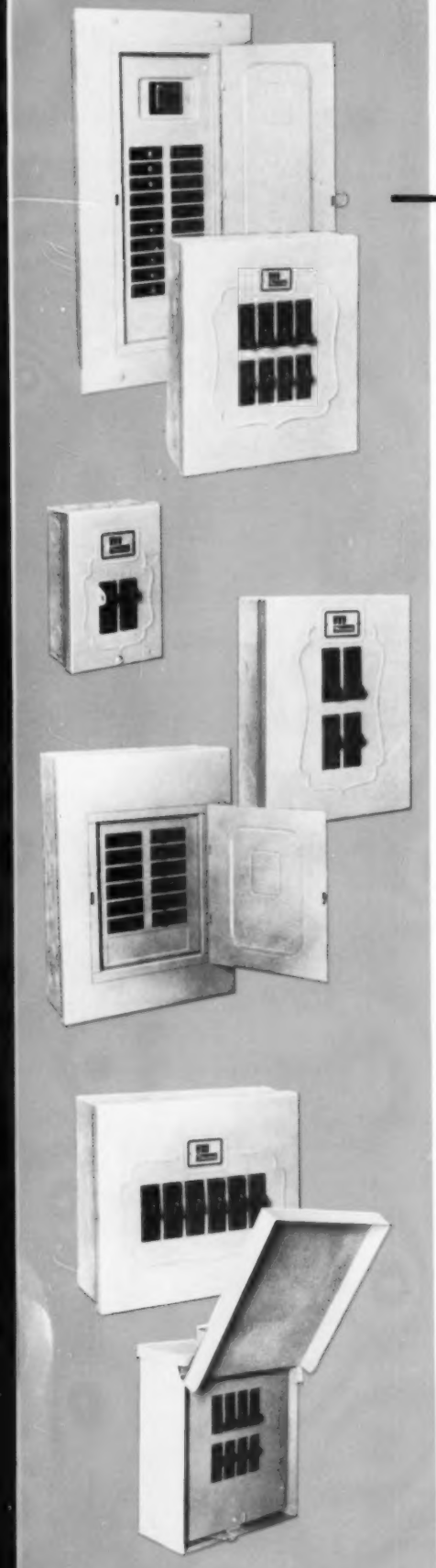


Chart **D**



FULL LINE of

"MP" load centers backs new breaker

De Luxe Features at Competitive Prices

New Murray "plug-in" Load Centers contain many of the well-known "easy-to-wire" features of other Murray service entrance equipment.

Contractors will be familiar, for example, with the "lay-in type" connectors and the special "pressure pads" for continually tight connections . . . ideal for aluminum conductors.

Other features include generous wiring room and the easy-to-remove KO's for which Murray boxes are famous. All current-carrying parts are plated, of course; and provision has been made for adding locks to devices with doors.

Still another feature is "alternate polarity bussing" for 2-pole circuits. So whether you're wiring up a house, store, or plant . . . specify *new* Murray "plug-in" Load Centers: the quality line at popular prices . . . perfect companion for the new "MP" breaker.

Write for full information on new "MP" Breakers and Load Centers.

- from 2 to 42 circuits
- competitively priced
- famous Murray easy-to-wire features
- raintight boxes
- surface and flush mountings
- split bus
- alternate polarity

Murray

"Quality doesn't cost . . . it pays!"

MURRAY MANUFACTURING CORPORATION
1250 Atlantic Avenue, Brooklyn 16, N. Y.

Murray Manufacturing Corp., Dept. ECM
1250 Atlantic Ave., B'klyn 16, N. Y.

Gentlemen: Please send me your 12-page booklet on the new "MP" Circuit Breaker and Load Center Line.

Name.....

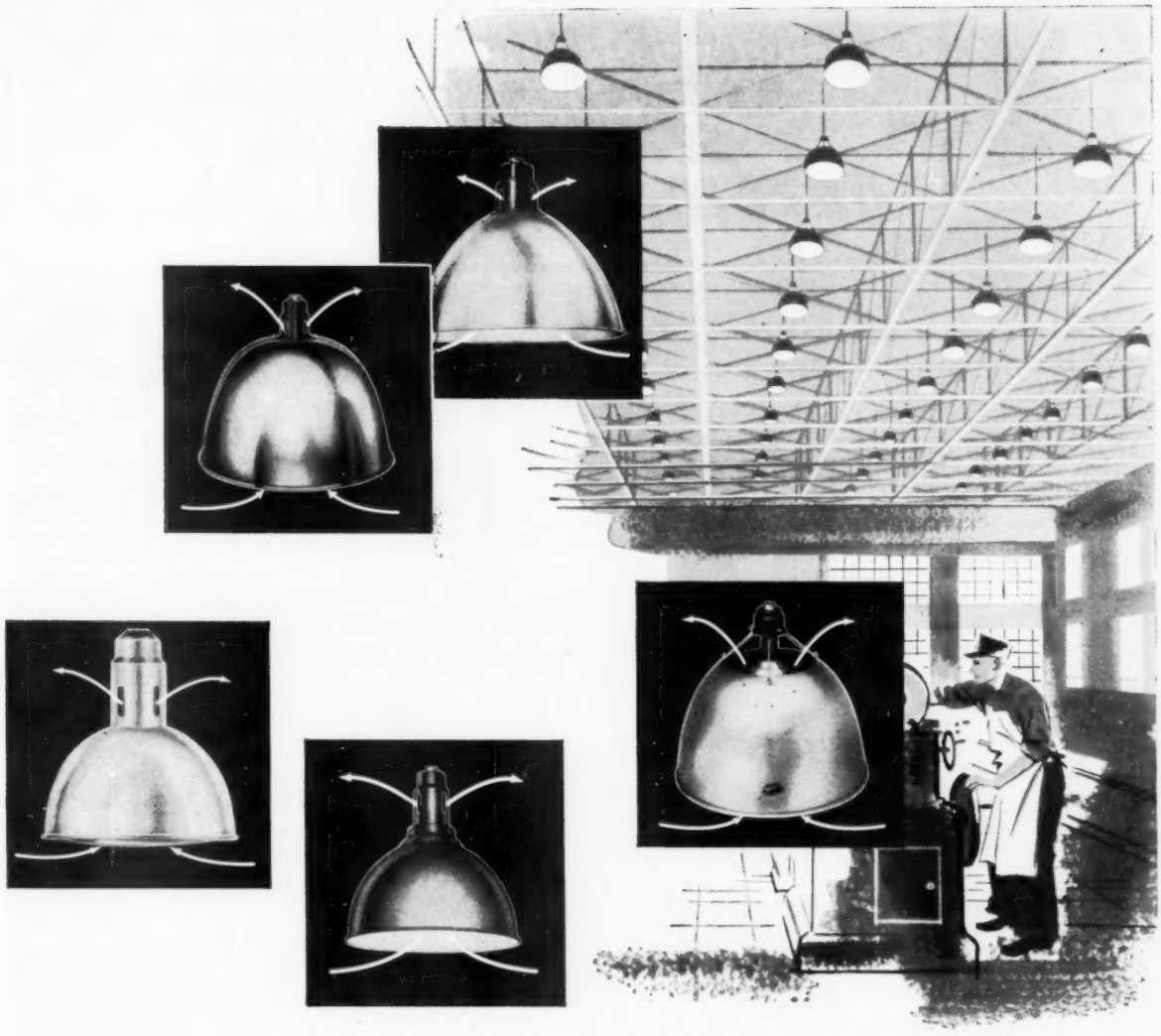
Company.....

Address.....

City..... State.....

Type of business.....

Send today for this booklet. Gives complete descriptive material on new "MP" line.



ABOLITE'S MODERN AIR-SWEPT DESIGN

reduces maintenance costs on high and medium bay installations

Air circulating through Abolite fixtures with *slotted neck* or *uplight* design are swept clean of dulling dust. Maintenance costs are kept down to a bare minimum.

NEW UPLIGHT FIXTURES FOR HIGH BAY

Abolite's uplight fixtures direct a portion of the light upward, eliminate sharp contrasts and glare by washing out deep background shadows. Abolite has the *right* fixture for every high or medium bay installation —*both* Alzak aluminum and porcelain enamel fixtures for all type 400 and 1000 watt mercury lamps; and for 300-1500 watt incandescent lamps.

Write for
FREE Brochure

This brochure will be helpful to you whether you design, specify or buy. It contains fact and performance data on all Abolite fixtures for high and medium bay lighting. Tear out coupon and send for your copy now.

ABOLITE
LIGHTING DIVISION
Jones Metal Products Co.
West Lafayette, Ohio

Gentlemen:
Please send me your brochure on Incandescent and Mercury fixtures for Industry. No obligation, of course.

Name_____

Address_____

City_____ State_____

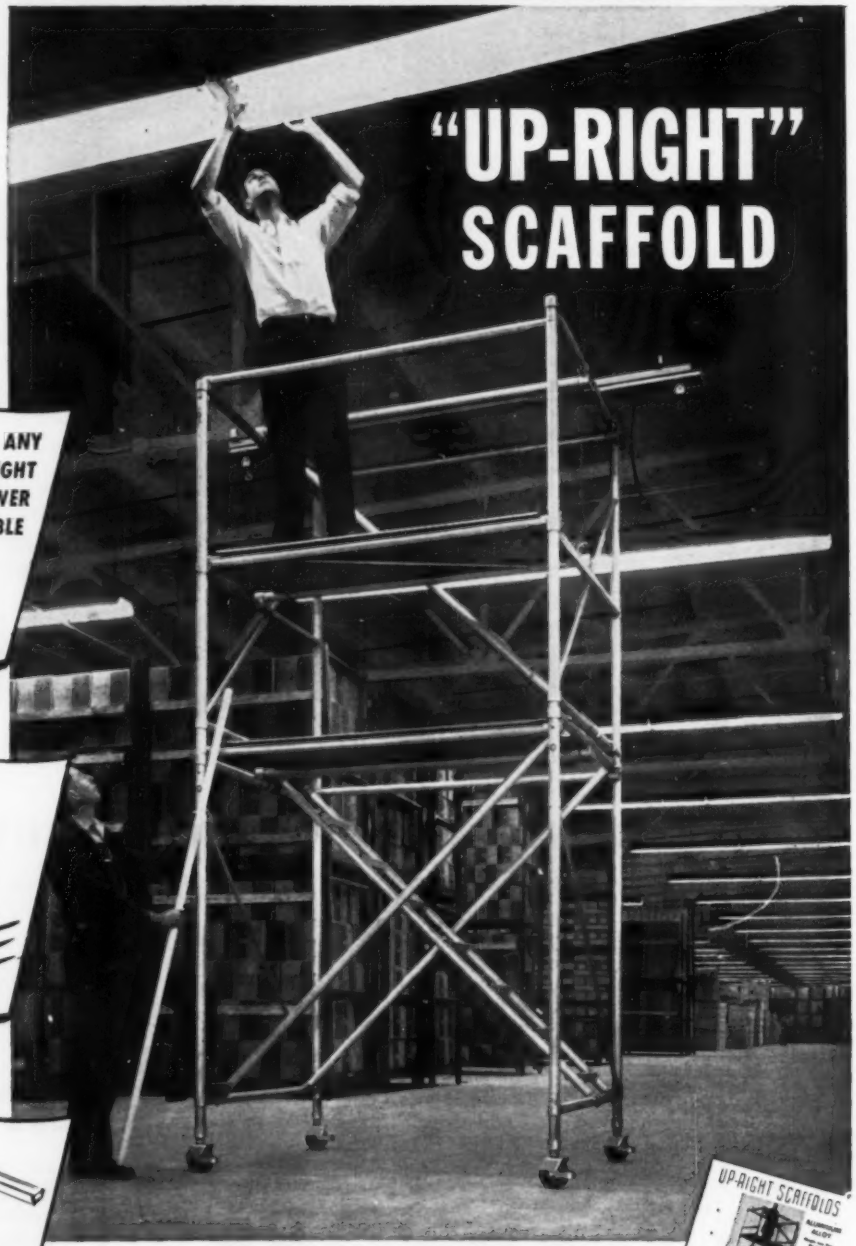
ABOLITE *Lighting*

THE JONES METAL PRODUCTS COMPANY
West Lafayette, Ohio

WALTER D. VANCE, JR., *Vice President* • *California Electric Co., reports:*

"We saved 14 days installing 527 fixtures by using 'UP-RIGHT' Scaffold-on-Wheels"

Man-hour savings on this General Motors warehouse job amounted to over 40%. Up-Right Scaffold is so light it is easily assembled by one man. Individual 1 piece aluminum alloy sections are unfolded and set one on top of the other. They lock into place instantly.



Write for descriptive circular ➡

"UP-RIGHT" SCAFFOLDS

Dept. 159 • 1013 Pardee Street • Berkeley, California

Factories: Berkeley, Calif. and Teterboro, N. J. Offices in all principal cities

10 EAST END AVENUE
NEW YORK CITY

BUILDER-OWNER
STANLEY R. BROFF
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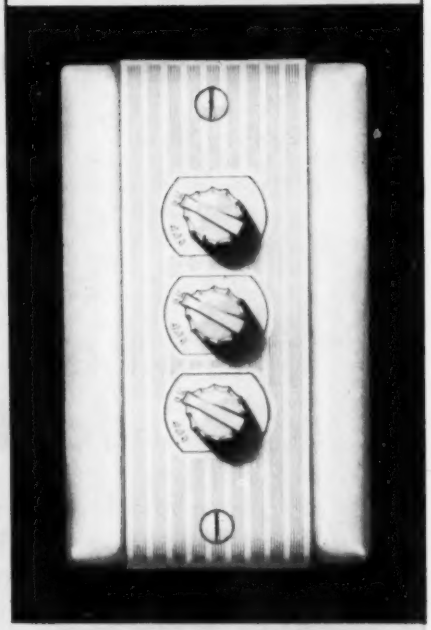
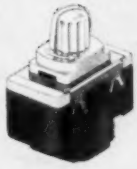
H. I. FELDMAN
ELECTRICAL ENGINEERS
AND CONTRACTORS
ZWICKER ELECTRIC CO., INC.



No. 1591-I
STRAP TYPE
ROTO-GLO
15 AMPERES



No. 1581-I
P&S DESPARD TYPE
ROTO-GLO
15 AMPERES

Combined with the 1500-I

Duplex Outlet is the ideal complement to Roto-Glo

ROTO-GLO® HIGHLIGHTS THE LUXURY LOOK...

One of New York's Newest Apartment Residences Features Roto-Glo

The experts agreed only Pass & Seymour's whisper-quiet, glow-in-the-dark Roto-Glo offered a beauty, convenience and test-proved functional perfection to match the modern interior of the outstanding new 22-story apartment residence, 10 East End Avenue, New York City.

More and more of today's most advanced planners are turning to tomorrow's finest switch—P&S Roto-Glo. It's the best answer to modern architecture's demands.

- Operates with quiet feather-light quarter turn.
- Soft, luminous glow in the dark.
- Full 15 Ampere rating for fluorescent and incandescent loads.
- Screwless terminals for quick, easy installation.
- Extra heavy construction . . . large, non-oxidizing silver alloy contacts.

For information on any of the wide range of P&S quality wiring devices, write Dept. ECM-258.

P&S®

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK
60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill.
In Canada: Renfrew Electric Limited, Renfrew, Ontario

MAKE THE COMPLETE JOB *COMPLETELY* P&S

ELECTRICAL CONTRACTORS! *There's a lot of useless back-breaking digging involved in uncovering new construction business . . . unless you have someone breaking ground for you . . .*

We help do your spadework for finding business

Trying to uncover new construction business by looking everywhere is the costly way to get the jobs you want. The best, most economical method is to let Dodge Reports pin-point exactly the kind of construction activity you're looking for right in the area you serve. If you'd like to see how this timely, accurate daily report service can get you more and better business, just read, then mail this coupon today.

TO: **DODGE REPORTS**, DEPT. 91, 119 WEST 40th STREET, NEW YORK 18, N. Y.

Yes! I'd like to see how to get more business by knowing in advance who's going to build, what, when, where.

I want to know whom to contact and when to submit bids.

I'd like to see some Dodge Reports, and I'd like a copy of your booklet that tells how to use this accurate, daily, up-to-the-minute construction news service.

I understand that I can pick just the area in the 37 Eastern States and the type of construction activity that interests me. Also, that I won't have to wade through mounds of data to find the information I need.

I'm interested in General Building ☐ **House Construction** ☐ **Engineering (Heavy Construction)** ☐

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Dodge Reports
For Timed Selling to the Construction Industry

No. 2 in a series

Right off the Wire

A double submarine cable, 2400 miles long, gives direct telephone service between California and Honolulu. It reaches ocean depths up to 3½ miles. Simplex manufactured 60% of the cable.

Dissimilar, non-ferrous metals, including aluminum, copper, magnesium, titanium, brass, zinc, silver and gold can now be bonded by a new ion-exchange process.

Doppler radar, installed in aircraft, is being tested by commercial transport planes. If satisfactory, it is expected to have far-reaching effects on civilian navigation.

By using a 3800-gallon bag of rubber-coated rayon to contain liquids, a truck trailer can now serve a double purpose. Various linings make the bags suitable for corrosive or edible liquids. It is planned to make them in larger sizes for barges or storage.

A new pencil feeds lead automatically to maintain the correct writing length.

A new low-temperature laboratory is equipped to produce fifty quarts an hour of liquid hydrogen at −423°F. and eight quarts an hour of liquid helium at −453°F.

A color-video tape recorder-player has been announced.

A new off-shore drilling platform is able to operate in 600 feet of water. Present equipment is limited to about 100 feet.

A model of an ion-propelled rocket has been exhibited. Theoretically it should have an efficiency of 90 per cent and a speed of 25,000 miles per hour. Power would be derived from a nuclear reactor.

A mechanical construction kit for adult tinkerers contains 5,000 parts. It is claimed that a working model of almost any machine can be built with it.

One of the new European cars has three headlights mounted side-by-side behind a screen of curved glass. The middle lamp is pivoted and turns with the wheels.

A single drop of a new adhesive, used to join two pieces of metal, has supported a load of 5,000 pounds.

Paint that changes color at high temperatures is being used in oil refineries as a safety measure.

Man-made lightning, to test insulated cable, is produced by the new 1,400,000-volt impulse generator in the Simplex research laboratories.

A new fuel for jet and ramjet engines has a boron-hydrogen base and should increase the range of aircraft using it by forty per cent.

A new kind of "electric eye" uses radiation from a small amount of strontium-90 instead of an electric light. It requires no power supply and is not subject to interference from dust or smoke.

A twenty-five acre business center, being built in Venezuela, is in the form of a helicoid. It will be 365 feet high and access will be by a spiral ramp. At the top will be a 170-foot aluminum dome housing an exhibition hall and television station.

A generator has been designed that produces electric power directly from the chemical reaction of hydrogen and oxygen.

Since 1950, over 4000 miles of cable protected by Simplex C-L-X type sheaths have been put in service. No sheath failures have been reported.

A new eighteen-pound refrigerator will operate for fifty hours on a bottle of propane gas, or indefinitely on household current.

The problem of shipping giant transformers by rail has been minimized by making the transformer the central part of the car. Both height and weight are thereby reduced.

Of current interest:

Recently, Simplex had the pleasure of publishing a new book called TRANSOCEONICS, depicting the historical development of underseas telephone cables. If you have read TRANSOCEONICS, you will recall the magnitude of some of the projects undertaken by Simplex.

We hope you will also remember that Simplex manufactures cable for nearly every electrical need, regardless of project size. All the proficiency acquired during our seventy years of leadership in cable manufacturing and research is at your disposal. Call or write to:

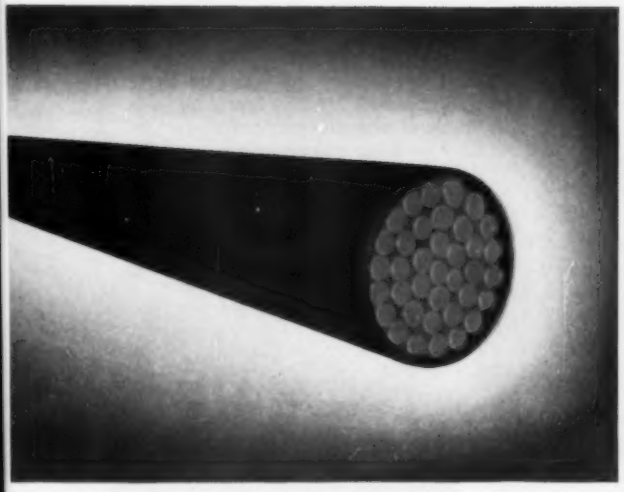
SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining · Power & Lighting · Construction · Transportation · Communications · Signalling

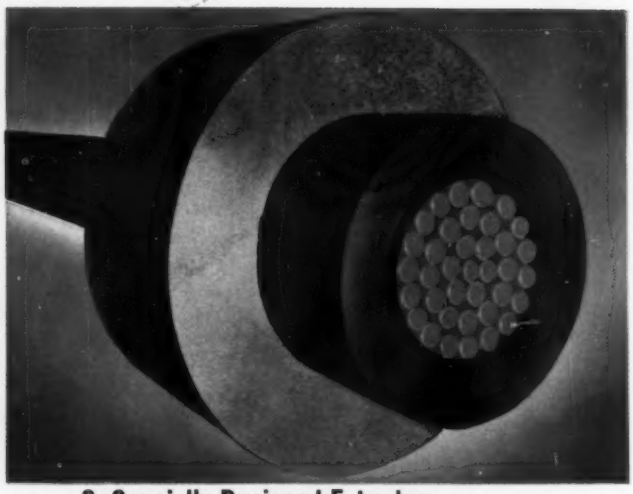
"the American manufacturers of transoceanic telephone cables"

How the Nepco Process makes Butyl better



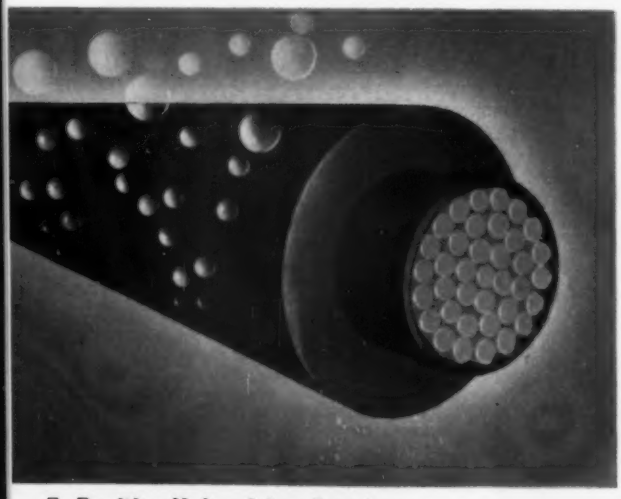
1. Vacuum Chamber Core Cleaning

All cores or copper stranding which in high voltage applications is normally wrapped in a special semi-conducting impregnated tape is passed through a high vacuum chamber to "boil-off" absorbed gases and moisture from the core.



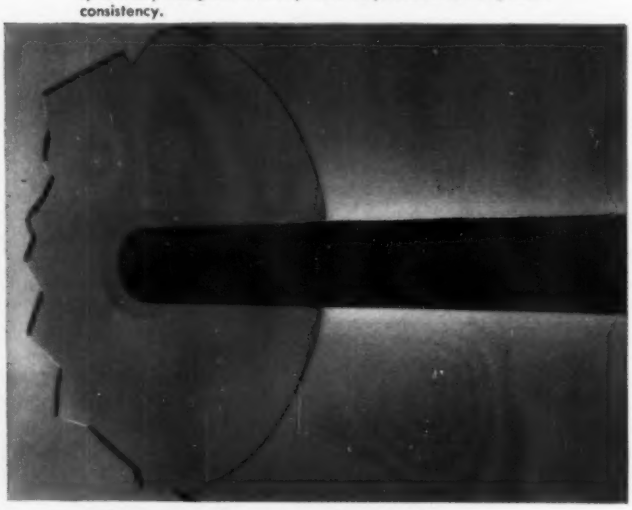
2. Specially Designed Extruders

After investigation, NE selected extrusion as the best method of applying a reliable dense, uniform insulation without troublesome interfaces. Since standard extruders were erratic in their capacity to process Butyl rubber, NE installed new equipment specifically designed to slowly work Butyl rubber at its optimum consistency.



5. Fugitive Vulcanizing Agents

Vulcanizing agents that leave the by-products of the vulcanizing action in the insulation reduce cable service life and electrical stability. NE has developed fugitive vulcanizing agents with volatile decomposition by-products that can be eliminated from the cable construction.



6. Pressure Vessel Vulcanization

NE Butyl is continuously vulcanized at over 400 degrees in a specially designed 200 foot pressure vessel . . . long enough to permit thorough saturation of the reactive centers and to allow the Butyl to interbond with the semi-conducting strand shielding tape to form a continuous mass.

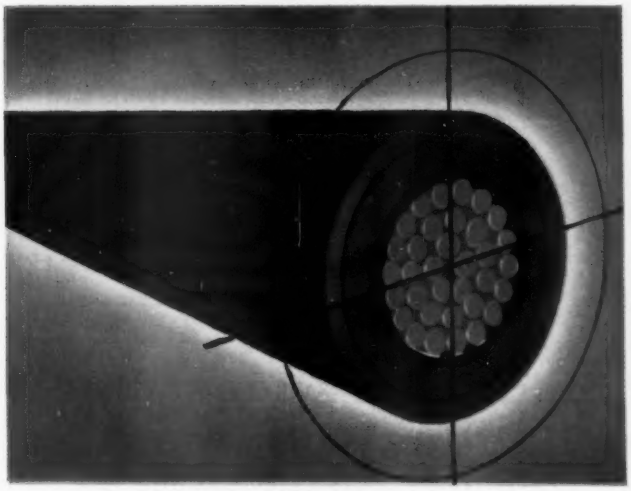
don't say <u>any</u> wire

Butyl rubber has inherent characteristics that make it an ideal insulating material for high temperature, high voltage wire and cable. It has outstanding resistance to heat, ozone and moisture.

To take full advantage of these characteristics requires special know-how and special equipment on the part of the wire and cable manufacturer. Here are eight things which National Electric does to get the best out of Butyl rubber and make NE Butyl insulated wire and cable the most dependable on the market.

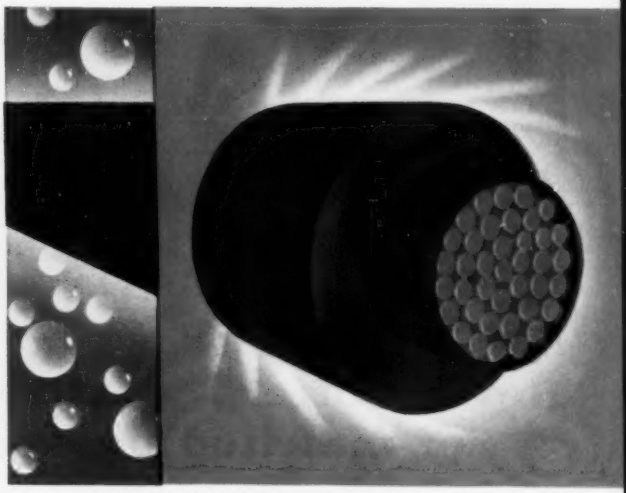
National Electric Products

Pittsburgh, Pa.: 2 Plants • 12 Warehouses • 41 Sales Offices



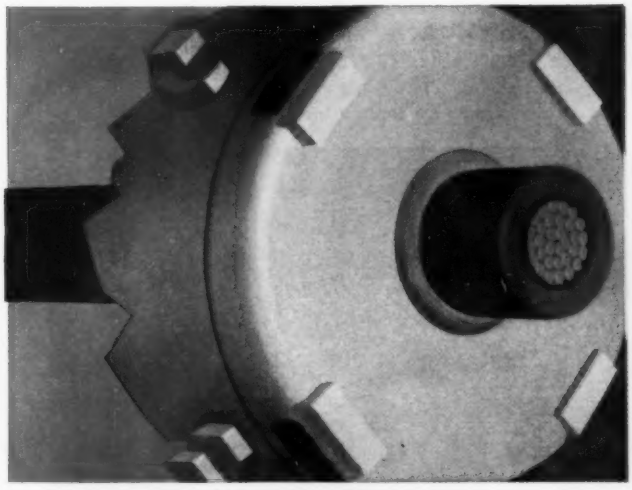
3. Controlled Concentricity

Every foot of cable is checked by a special monitoring station to maintain a perfectly centered core and uniform wall thickness before the material enters the vulcanizing chamber.



4. Water Cushion Processing

NE Butyl Rubber rides into the vulcanizing chamber through a high pressure water seal that molds the rubber uniformly onto the cable, impregnates the interstices of the shielding tape before vulcanization.



7. Pressure Vessel Cooling

Perhaps the most important part of the Nepco process. NE Butyl insulated cable is slowly cooled in a second pressure vessel under the same pressure at which it was vulcanized. This cooling under high pressure forces gaseous by-products out of the insulation . . . permits the use of volatile vulcanizing agents which leave no harmful residuals behind.

The inherent inertness of the Butyl rubber polymer permits the insulation to be compounded and vulcanized to a much tougher and mechanically stronger material.

A typical National Electric Butyl formulation has at least twice the tensile strength specified for an oil base insulation and will maintain this margin of superiority during long term accelerated service tests. Write today for National Electric's new booklet on Butyl insulated wire and cable.

. . . say NE wire

Denver's Washington Park tennis court is illuminated with Revere "4200" series floodlights and poles. One of eight such courts lighted by the city of Denver with Revere lighting fixtures.

Lighting tennis courts or airports—

Revere offers you the industry's widest line of matched outdoor lighting fixtures

Whether your job calls for two floodlights or fifty mercury luminaires, you can easily plan your installation working from one catalog when you specify Revere fixtures. From the industry's widest line of matched outdoor lighting components you can order with assurance. Assurance that you will find the equipment you need. Assurance that shipments will be planned to coincide with your job schedule.

Look into these—and the many other time and money-saving advantages of Revere's wide line of matched lighting fixtures. Ask your wholesaler how Revere components can help you with your next outdoor lighting job.

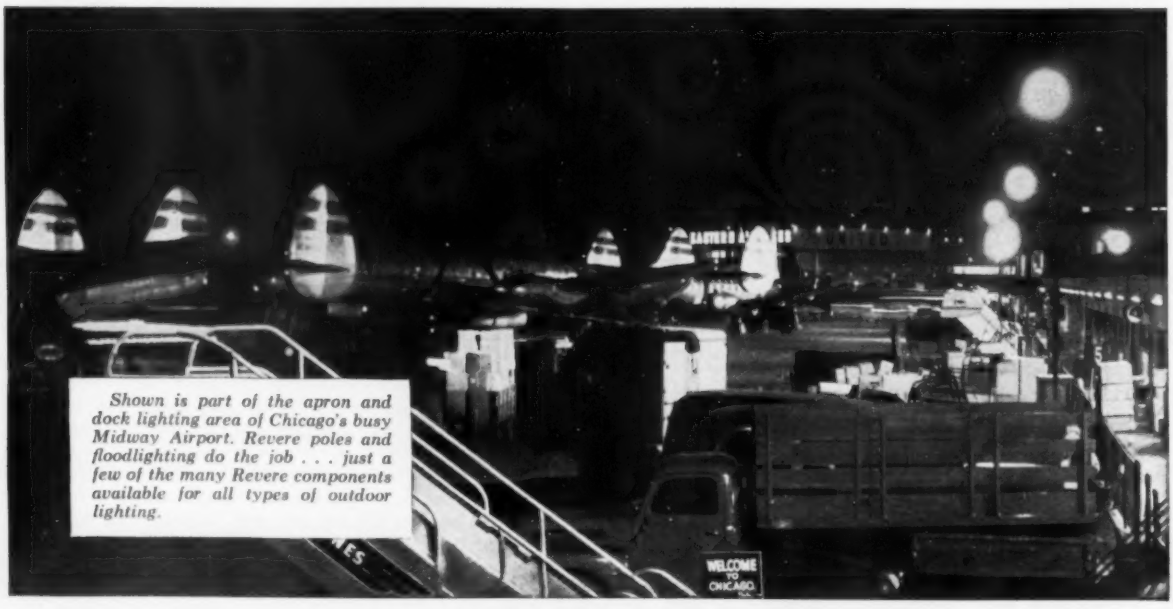
Revere ELECTRIC MFG. CO.

Write for Revere's complete catalog

Revere Electric Mfg. Co., 6009 Broadway, Chicago 40, Ill., UPtown 8-7100

Available in Canada thru Curtis Lighting Ltd., Leaside, Toronto, Ontario

OUTDOOR LIGHTING: Industrial • Commercial • Service Stations • Streets • Sports • Airports • Shopping Centers



Shown is part of the apron and dock lighting area of Chicago's busy Midway Airport. Revere poles and floodlighting do the job . . . just a few of the many Revere components available for all types of outdoor lighting.

Specify PHELPS DODGE HABIRITE-INSULATED ARMO-LOK CABLE

Phelps Dodge Armo-Lok cable with Habirite (butyl rubber) insulation—a companion to Phelps Dodge Varnished Cambric insulated interlocked armor cable—is more than "just another interlocked armor cable."

Habirite—developed through years of Phelps Dodge experience in the design and manufacture of high voltage cables — is a specially engineered butyl rubber compound. It far surpasses any other type of rubber insulation for dependable service.

Habirite offers these distinct advantages over other rubber insulations:

- Far greater resistance to heat and oxidation with consequent higher temperature rating and lower conductor size and cable cost.
- Far greater resistance to ozone found around high voltage equipment.
- Far greater mechanical toughness.
- Better electrical properties affording a greater safety factor in operation.
- Highest uniformity due to controlled uniformity of raw material.

★ ★ ★

See your Phelps Dodge distributor for information on a complete Armo-Lok system. For catalogue and specification data on Habirite or Varnished Cambric insulated Armo-Lok cable, write: Dept. E6, Phelps Dodge Copper Products Corporation, 300 Park Avenue, New York 22, N. Y.

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

magic frame
TROFFERS

troffers with

One piece Reflector Plate ✳ Wireway

now makes recessed lighting . . .

so simple to install!

The one piece Reflector Plate-Wireway on which the electricians above are working contains all the electrical components of the "Magic Frame" Troffer. Entire troffer consists of just three parts: (a) Recessed chassis, (b) One piece Reflector Plate-Wireway, (c) Hinged door. No loose nuts or bolts, every movable part is captive or pre-positioned.

1. One man can install recessed chassis because weight of ballast is eliminated and patented "Speedy Latch" immediately holds chassis to ceiling.

2. Reflector Plate-Wireway suspended and securely attached to chassis by means of jack chain and "S" Hooks. With both hands free, splicing and pulling of wires is effortless.

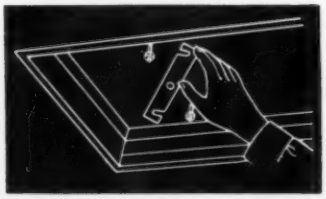
3. Reflector Plate-Wireway can be entirely removed from chassis for easy electrical maintenance and repair.

4. "Magic Frame" Doors lock securely, open on two concealed hinges . . . may be removed by merely lifting and shifting. No tools required!

5. Actually a screwdriver is all you need to install "Magic Frame" lighting! No bolts, screws, hinges or light leaks to mar the clean, smooth ceiling line.

6. "Magic Frame" Troffers are available in all types of flat and curved glass, metal and plastic louvers—**including ½" plastic cube.** Doors are interchangeable.

EXCLUSIVE "ADJUSTO-HANGERS" eliminate need for precise positioning of troffer, insure perfect alignment, permit one man installation. Once installed, chassis need never be disturbed.



PATENTED "SPEEDY LATCH" eliminates loose screws and bolts, allows one man installation. Just a turn of the "Speedy Latch" locks chassis to the ceiling.

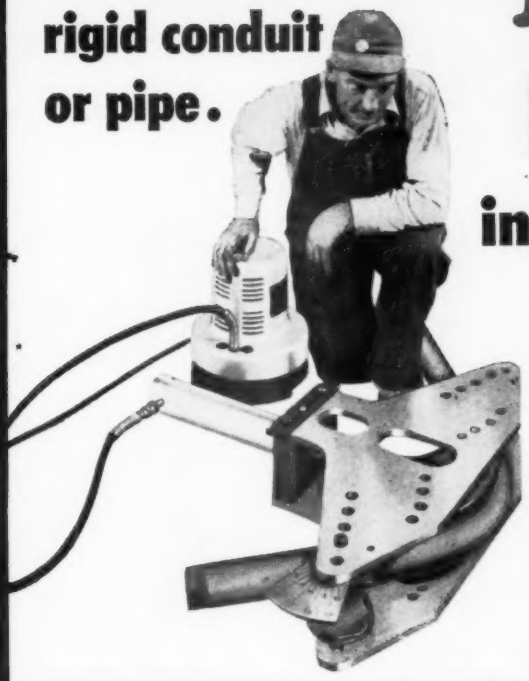
Write for complete Data and Specification Catalog today!

Electro Silv-A-King Corporation

1535 S. PAULINA ST., CHICAGO 8, ILLINOIS • SPRUCE & WATER STS., READING, PENNSYLVANIA • 780 BROADWAY, REDWOOD CITY, CALIFORNIA

DESIGNERS AND MANUFACTURERS OF THE FINEST IN LIGHTING

For thin-wall or rigid conduit or pipe.



BLACKHAWK PIPE BENDERS

in *every* size and price range!

You look ahead to amazing savings when you look over the *world's most complete line* of pipe benders . . . yours from Blackhawk. First choice with electricians everywhere! Exclusive advanced designs do the hard work for you . . . pay for themselves in 2 or 3 jobs! Be prepared to save up to 77% over cost of manufactured ells.

New super-portable featherweight aluminum models are easiest to set-up! Make bends in 3" pipe in just *one bite!* Turn out neater, more accurate jobs in half of the time required by ordinary benders.

Check this chart now. Then select the Blackhawk that is *just right* for you.

MODEL	PUMP	DIAMETERS
S-30A	Hyd. hand pump	1, 1¼, 1½, and 2" rigid conduit and pipe
S-34	Hyd. hand pump	1¼, 1½, 2" thin-wall conduit
S-36	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½; 4" rigid conduit and pipe
New S-130 1-bite	Hyd. hand pump	½ - 2" rigid conduit and pipe
New S-132 1-bite	Electric-powered pump	½ - 2" rigid conduit and pipe
New S-137	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe
New S-138 1-bite	Hyd. hand pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe
New S-139 1-bite	Electric-powered pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe
New S-140	Electric-powered pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe

One bite does it! NEW Blackhawk aluminum benders slash costs 77%!

NEW S-130 FEATHERWEIGHT ALUMINUM BENDER for ½ to 2" pipe and rigid conduit—make full 90° bends in just one operation! Speeds making 180° bends, double offsets and compound bends. Cuts bending time in half! See for yourself! Try one on your next job.

NEW S-140 FEATHERWEIGHT ALUMINUM BENDER for up to 4" pipe—Electric power operated. A cinch for one man to assemble and carry right to the job! Bends up to 3" rigid conduit in one lightning pass! Only 3 quick setups are needed for 3½ and 4" 90° pipe bends.

EXCLUSIVE "OPTIK-ANGLE" GAUGE. A magical time and work saver! Gauge is mounted right on bending shoe to give exact degree of bend during bending operation. Gone are guesswork, time-wasting measuring for determining correct degree of bends!

ALUMINUM REMOVABLE TOP PLATE. "Lock-on" shoes—no threading of shoes on ram—simply place them in position and insert lock pin. Pipe is quickly positioned from above rather than "muscled" in from side. Top-plate has snap action, quick-lock bolt.

WHOPPING 77% SAVED ON BENDS! Dietz Electric Co., project foreman says, "Last job, we saved more than $2,000 compared to manufactured ells. From now on, Blackhawk S-139 is our production bender." Try Blackhawk . . . the fastest bender on the market today.

BLACKHAWK bends prove BLACKHAWK'S best!

SEE YOUR DISTRIBUTOR ... TODAY!

. . . choose from his *complete* Blackhawk stock!

BLACKHAWK

BLACKHAWK MFG. CO., MILWAUKEE 46, WIS.

Sylvania's R-52 lamp has a sealed-in reflector that never dims . . . produces more light where your customers want it . . . makes costly fixture care unnecessary.

Sell this Sylvania reflector lamp that gives all downward **working** light . . . no upward **wasted** light

Sylvania's R-52 reflector lamp has helped industrial plant management to effect important lighting economies, and achieve greater lighting efficiency.

The R-52 reflector lamp is a "high-bay" lamp particularly suited to overcome many of your customers' plant conditions of severe dirt, grease and smoke. Its *sealed-in aluminized* reflector is 100% dirtproof . . . eliminates the need for costly, time-consuming fixture cleaning . . . and provides your customers with greater efficiency throughout the life of the lamp.

As an integral part of the Sylvania R-52, the reflector is angled to concentrate a maximum of usable working light downward . . . helps increase productive efficiency . . . and provides more useful light for the same wattage.

Take advantage of sales opportunities offered by the Sylvania R-52 lamp . . . available in 500- and 750-watt sizes. Demonstrate its superiority as a highly efficient light source that defies light-dimming dirt and grime . . . saves time and dollars by eliminating costly fixture care . . . and helps increase working efficiency with more working light.

For complete information, call your Sylvania Representative or write:

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Dept. 8L-8302
60 Boston Street, Salem, Mass.
In Canada:
Sylvania Electric (Canada) Ltd.
Shell Tower Building, Montreal

SYLVANIA... *the fastest growing name in sight*

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

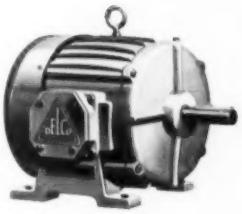
DELCO DOUBLE CHECKS THE FIT

Bearings and housings are measured and color-coded for selective fit

After bearings and housings for Delco Electric Motors are machined to precise tolerances, both are re-measured and selectively mated for closest fit. Then, to complete the marriage, color-coding is used to mark perfect pairs. Result: accurate alignment and extra long wear . . . added value that saves you money.

Such thoroughness and care are evident at every step of building Delco Electric Motors as well as in the generous use of quality materials. Take Delcote insulation, for instance. This Delco exclusive for integral horsepower motors is the sure defense against dirt, vibration, moisture and abrasion.

Consider all the extras in Delco Electric Motors and you'll know why it pays to contact your Delco Products Distributor or Sales Office for the correct solution to any motor problem.



Delco Electric Motors, precision-built from end to end, are available in a wide range of sizes and styles to 200 h.p.

GM GENERAL MOTORS

DELCO MOTORS

Delco Products,
Division of General Motors, Dayton, Ohio

- APPLIANCE MOTORS • INDUSTRIAL MOTORS
- GENERATORS • ACTUATORS
- AUTOMOTIVE AND HYDRAULIC EQUIPMENT
- HERMETIC MOTORS AND CONTROLS
- RESIDENTIAL GARAGE DOOR OPERATORS
- AIR SUSPENSION COMPONENTS

General Electric says:

"On the average, only 1 out of 100 G-E Lamps will burn out during the first year of service in a single shift operation."

Harold Kilburg, electrical contractor, says:

"Out of 5,150 G-E Lamps we installed a year ago, we've had to replace only 20. That's 1 out of 250!"

MR. KILBURG (center), president of Kil-Bar Electric Co., Chicago, inspects one of the G-E Lamps that has given such excellent service. Leo Carmody (left), wholesale agent salesman, and Larry King, G-E Lamp Salesman, worked together on this installation.

Cost of light is about 10 times the cost of the lamps. It is also the cost of the electricity used . . . and the cost of maintaining the system. If you specify lamps with unpredictable life, your customers will have lots of early burnouts. But G-E Lamps have a uniform life with few early burnouts. This means G-E Lamp users can schedule an economical group relamping program (replace all their lamps at the same time) and realize big savings in maintenance that far outweigh the little light left in the lamps. For full information on this way to improve your customers' lighting and save them money, too, write: General Electric Co., Large Lamp Dpt. EC-28, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

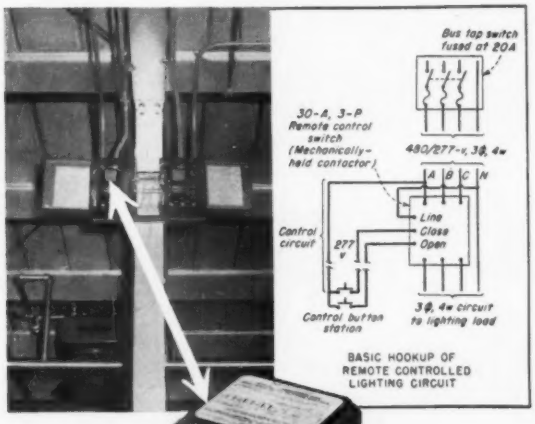
G-E LAMPS GIVE YOU MORE FOR ALL YOUR LIGHTING COSTS

The case for 277 volt lighting and ASCO Remote Control Switches

AT THE NEW ASCO PLANT...

Remote Control Switches for feeders and branch circuits greatly simplify load control. Fast and reliable on-off control over large blocks of 277 volt lighting can be exercised from any control point.

ASCO Bulletin 920 Mechanically Held Remote Control Switches (shown mounted on a column) control large blocks of lighting in the manufacturing area. Control is by push-button from a convenient point.



BASIC HOOKUP OF REMOTE CONTROLLED LIGHTING CIRCUIT

The Bulletin 920 Remote Control Switch is U. L. approved to 600 Volts A-C, and is catalog listed in sizes from 30 to 200 amperes, 2 and 3 pole.

Use of the 277/480 volt Wye system and development of the 277 volt discharge lamps were made possible by the 1953 Code. Section 2113 extended the higher voltage branch circuits as follows:

> "Section 2113, Voltage. (2) in Industrial establishments, office buildings, large schools and stores, the voltage of branch circuits which supply only the ballasts for electric discharge lamps in permanently installed fixtures mounted not less than eight feet from the floor, which do not have manual switch control as an integral part of the fixture, may exceed 150 volts to ground, but shall not exceed 300 volts to ground."

The expanded use of 277 volt lighting in office buildings, factories, stores, schools, and technical centers results from the many advantages of this system:

1. Reduction in number of circuits—since loads can be combined
2. Reduction in wire sizes
3. Increase in the number of fixtures per branch circuit (2.3 times 120 volt systems)
4. Use of same system for both power and lighting

Substantial blocks of 277 volt lighting can be controlled remotely through the use of ASCO Remote Control Switches, providing these advantages:

Installation Economy—Distribution panels can be located to provide straight feeders and short branch circuits, resulting in minimum line drop and losses.

Control Convenience—Control stations located conveniently—connections made using small wires provide instant disconnect of lighting and power feeders.

Design Simplicity and Flexibility—Logical distribution determines design—makes wiring layout simple and flexible for future expansion.

Safety in Emergencies—Instant control of vital circuits from one or more accessible locations.

And ASCO Remotes can be used up to their full rating on 277 volt fluorescent loads.

DEPENDABLE CONTROL BY ASCO

ASCO Mechanically Held Electrically Operated Remote Control Switches are ideal for 277 volt lighting applications. ASCO Remotes are unaffected by line voltage conditions, and respond only to the control of the pushbutton, time switch, relay or other controlling device. These switches are available from 30 to 1000 amperes—to 750 volts A-C or D-C—for all classes of load.

For complete engineering information on Remote Control Switches, write for new Catalog 57-52.

Automatic Switch Co.

50-J Hanover Road, Florham Park, New Jersey

FRontier 7-4600

ASCO®

Reflecting Modern Power Distribution Techniques...

COMMERCIAL
POWER
DISTRIBUTION

12 KV POWER feeds metal-clad switchgear ❶ consisting of one incoming, two feeder breakers. It then goes to 225-kva load center unit substation ❷ serving data process center; 750-kva unit ❸ for motor control center, 277-v lighting, computer air conditioning; 500-kva unit ❹ supplying 120-v office and cafeteria equipment, lighting. Two units—500 and 1000 kva—placed elsewhere, supply building's heating, air conditioning and office area loads.

New Fireman's Fund Building Utilizes General Electric 480Y/277-Volt System

System-engineered equipment achieves large savings, aids efficient operation of insurance firm home office

DESIGNED FOR EMPLOYEE EFFICIENCY AND COMFORT, the Fund Insurance Company's new home office is a dramatic addition to San Franciso's skyline. High-level lighting, year-round air conditioning, 190,000 sq. ft. of flexible office space, modern business machines, and built-in design features permit a 900-member staff to handle The Fund's operations smoothly, efficiently.

LARGE SAVINGS were achieved by adopting a General Electric 480Y/277-volt power distribution system for combined light and power loads. Due to higher voltages, smaller conductors and fewer wiring circuits were possible, and separate lighting power supply substations were eliminated. Added values: flexibility features of G-E 480Y/277-v systems provide capacity to handle future load growth; equipment economies were provided by using primary power and unit substations. Interrupting capacity at any point of the secondary circuits was lower than that possible with direct connection to a secondary system.

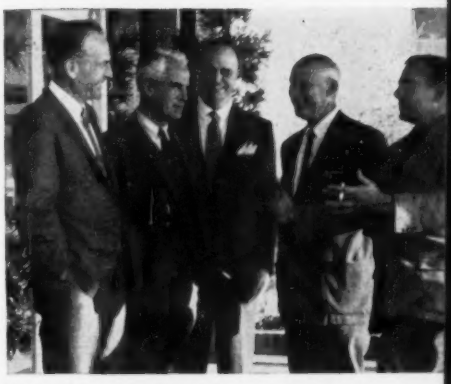
PROJECT TEAMWORK facilitated installation and startup of the electrical system. Working closely with officials of The Fund and their consultants*, G-E engineers conducted a system analysis early in project planning. General Electric also recommended basic system layout, provided service engineering and installation assistance at the site.

GENERAL ELECTRIC SYSTEM ENGINEERING CAN HELP YOU on your construction project. G-E engineers are available at all times to assist you and your consultants in planning your electrical system. Contact your nearest G-E Apparatus Sales Office or write General Electric Co., Section 680-13, Schenectady 5, N. Y.

* Architect: Edward B. Page, A.I.A.
Electrical Engineer: Clyde E. Bentley
General Contractors: MacDonald, Young & Nelson, Inc.
Electrical Contractor: Ets-Hokin & Galvan

Engineered Electrical Systems for Commercial Buildings

GENERAL ELECTRIC



PROJECT PLANNERS N. A. Begovich, Fireman's Fund official; Edward B. Page, architect; F. N. Blum, G.E.; Clyde E. Bentley, consulting engineer; J. M. Ets-Hokin, electrical contractor.

GLARE-FREE 277-V FLUORESCENTS in unique fixtures achieve ideal brightness ratio for office areas, create savings by combined lighting system, power source.

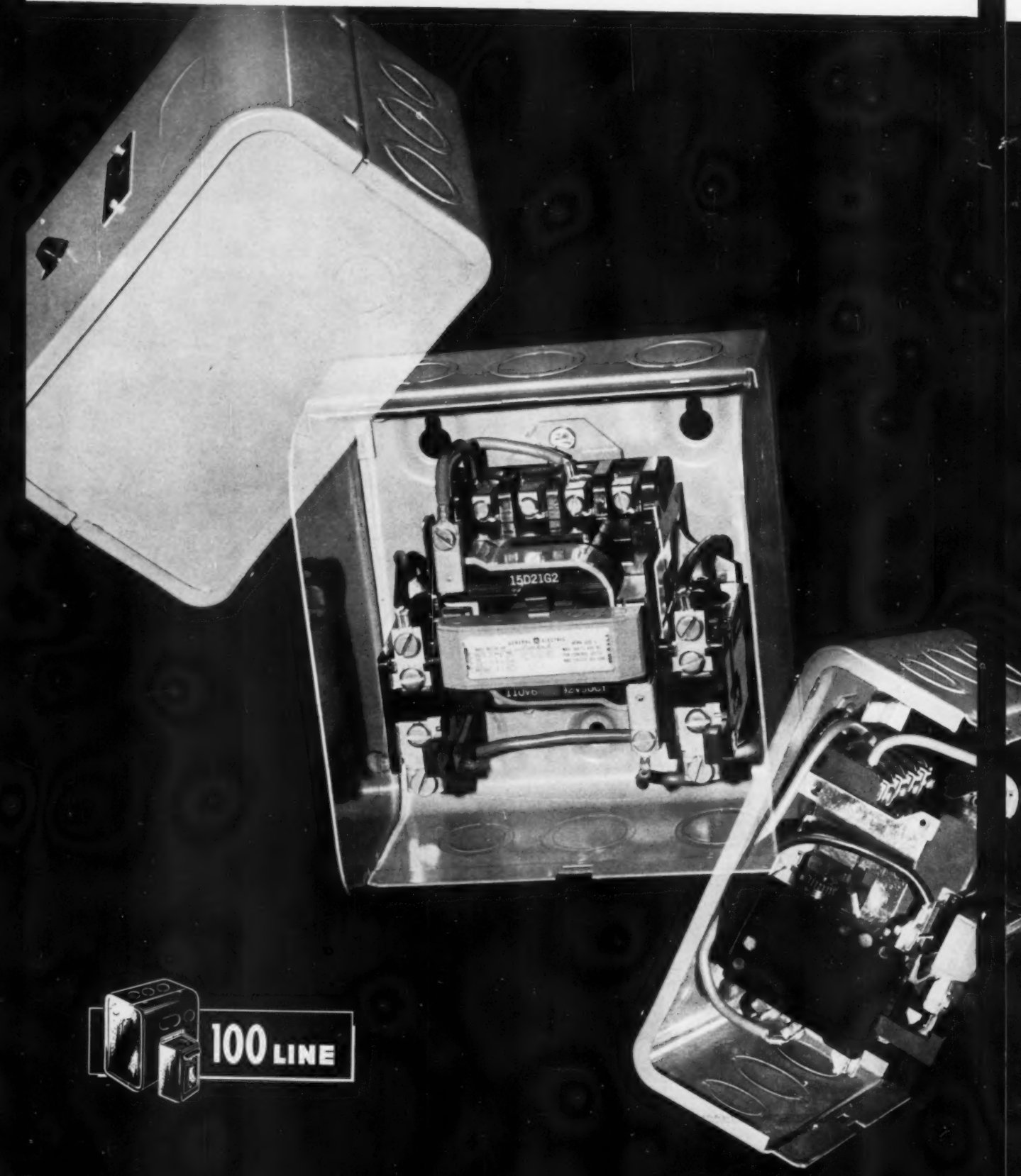
PROJECT POWER serves G-E 12 kv metal-clad switchgear lineup of main, two outgoing breakers to five unit substations.

OPERATING EASE, reliability of G-E drawout switchgear with AK-1 breakers provide safer switching of 480-v feeders.

500-KVA unit substation, with Pyranol* transformer, serves 120-v needs directly, 480-v loads through 150-kva transformer.

* Registered Trademark of General Electric Co.

REMOVABLE SIDES PROVIDE 180° ACCESSIBILITY—



100 LINE

MAKE THE RADICALLY NEW GENERAL ELECTRIC SIZE 0 AND 1 MAGNETIC STARTERS

EASY TO INSTALL

From enclosure to terminals, these new, radically different General Electric magnetic starters have been designed to simplify installation and wiring. Here's how:

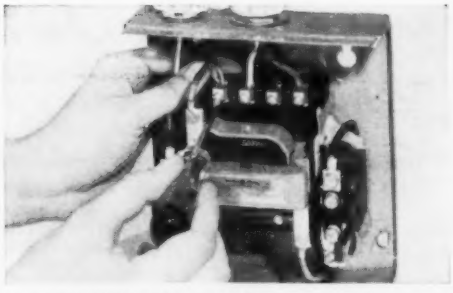
180° ACCESSIBILITY. Both the enclosure cover and sides are easy to remove. Just press the spring-clip latch, and the wrap-around cover is released. Each side is held to the back of the enclosure by two screws. Just a half turn of each screw and the side can be removed. You have 32% more wiring room in the new General Electric enclosure—even with the sides on.

FRONT WIRING. All wiring on the new General Electric starters is done from the front. All line terminals are at the top, and all load terminals are at the bottom. Straight-through wiring and new pressure-type terminals save you time because no wires need be bent or looped.

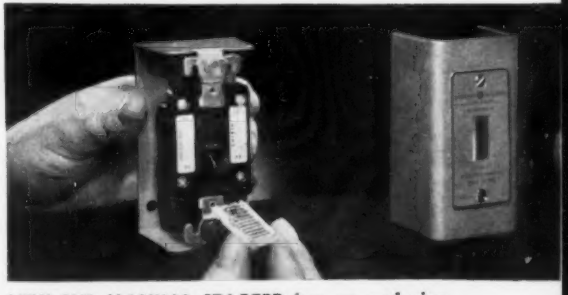
Like more information? Contact your nearby G-E Apparatus Distributor, or write to Section 733-39, General Electric Company, Schenectady, N. Y. and ask for bulletin GEA-6611.

General Purpose Control Department, Bloomington, Illinois.

GENERAL ELECTRIC



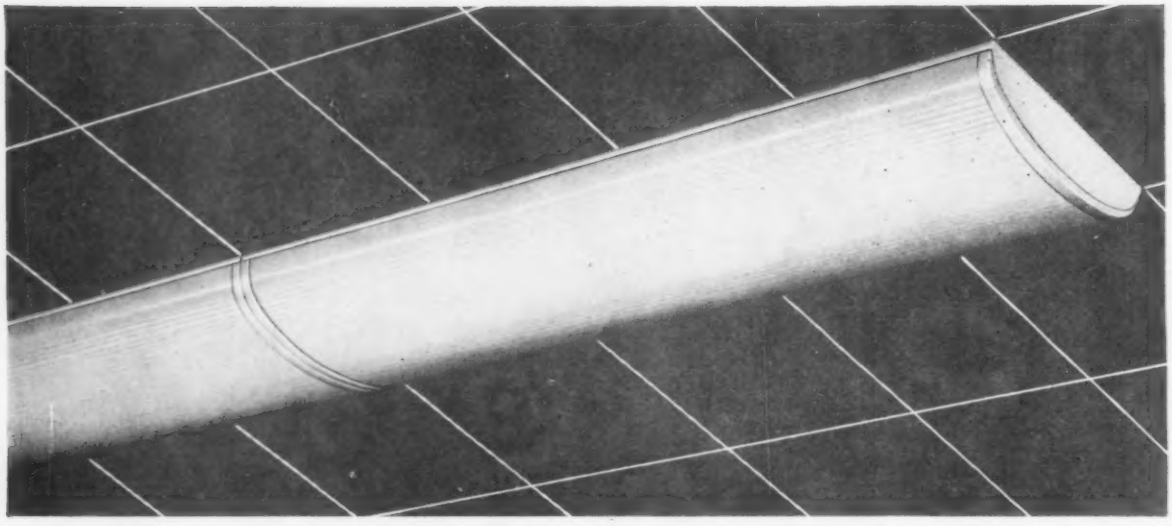
EASIER WIRING is possible because of greater wiring space in the enclosure, and greater accessibility made possible by the removable sides.



NEW FHP MANUAL STARTER has an exclusive plug-in overload relay heater and fits any standard wall box. Ask for bulletin GEA-6388.

"Built-In" look...

Surface-Mounted Cost



GARCY Ultra-Lux . . . shallow, plastic enclosed fixture . . . ideal for low ceiling lighting

Minimum depth consistent with good light distribution and brightness control

With curved shield, unit is only 3¼" at its deepest point . . . yet surface brightness is virtually uniform at all viewing angles and well within acceptable limits for glare-free comfort.

Improved light-stable extruded plastic guaranteed not to warp or discolor

Shield is of Koppers improved EVENGLO*, a premium-grade polystyrene with built-in resistance to discoloration caused by ultra-violet radiation of fluorescent lamps.

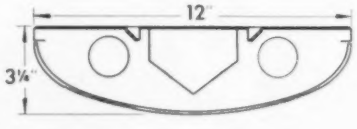
**EVENGLO is a registered trade mark of Koppers Company, Inc.*

Easy to install . . . only two basic parts

Completely assembled chassis with integral end plates is lightweight, sturdy, easy to handle. Separately cartoned one-piece shield hooks on after installation.

Easily cleaned . . . no need to remove shield from fixture

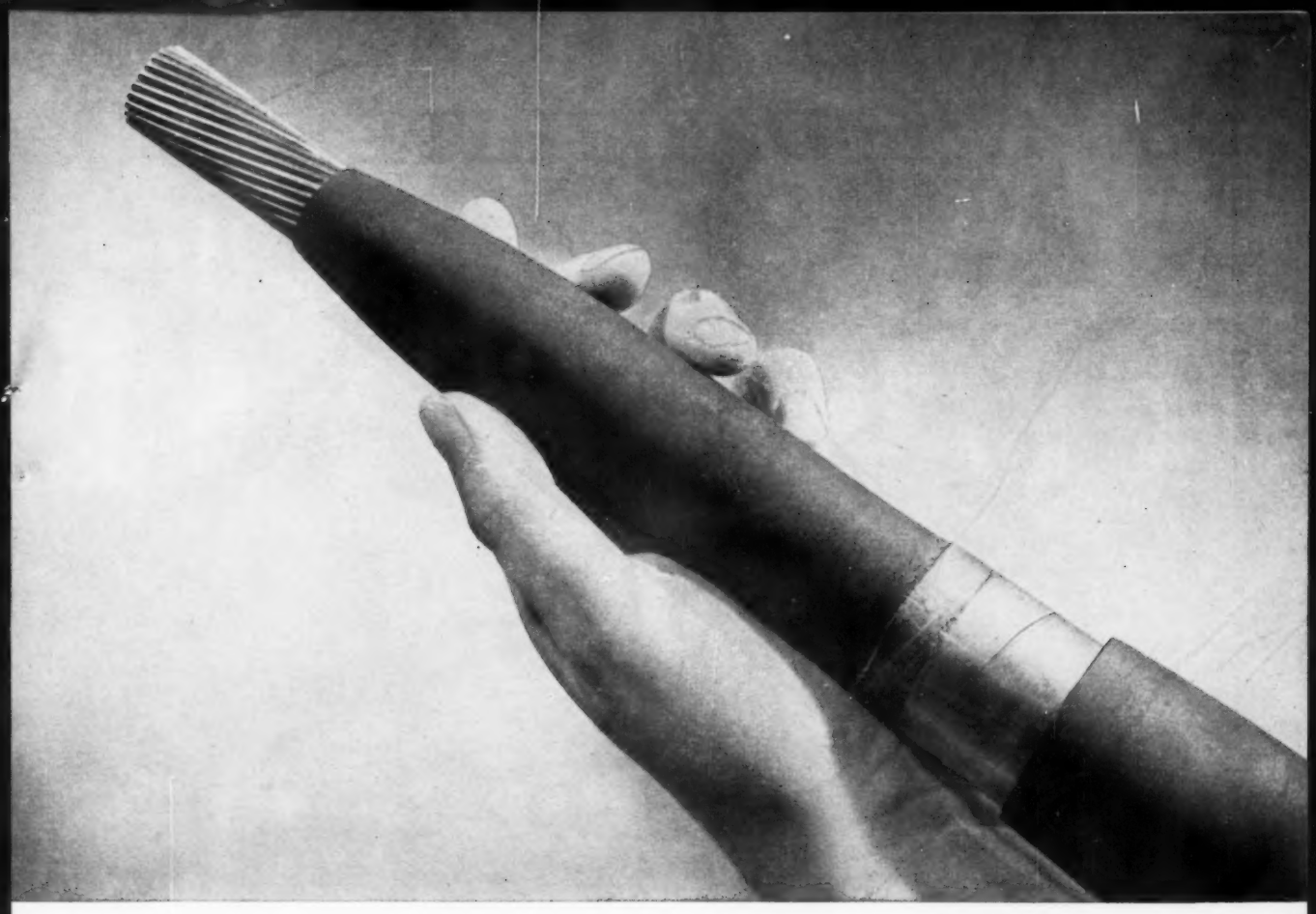
Curved shield is invisibly framed and hinged . . . lets down at a touch, wipes clean in seconds.



GARCY
Preferred for Performance
COMPLETE COMMERCIAL LIGHTING

Garcy offers a complete line of lighting fixtures for commercial, institutional and display lighting.

Garden City Plating and Manufacturing Company
2475 Elston Avenue • Chicago 47, Illinois
In New York City—48 West 48th Street
In Los Angeles—Garcy Western Corporation, 3912 Broadway Place
In Canada—Garcy of Canada, Ltd., 1244 Dufferin Street, Toronto



Here's the cable that beats heat, moisture and ozone—KEYSTONE BUTYL

Ready for splicing, this Keystone butyl-insulated cable will soon be fighting the three most common saboteurs of electrical cable.

HEAT. Conductor temperatures of up to 90C don't faze Okonite Keystone butyl-insulated cables. This means (a) given conductor sizes can carry heavier loads, (b) given loads can be carried on smaller cables, (c) cables can work in such hot surroundings as boiler rooms and crowded ducts without fear of failure.

MOISTURE. Keystone butyl-insulated cables leave industry standards far behind . . . retain stable electrical and physical characteristics in the wettest installations. Here's clear proof that these cables may be used with confidence even for direct burial in damp locations.

OZONE AND CORONA CUTTING. Keystone butyl-insulated cables withstand a longer test period and sharper bends than required by the industry for ozone-resistant compounds. In actual operation, these cables have met even higher requirements for superior stability and long life—Okonite's *own* standards.

Write for the Keystone butyl story—complete. Over 12 years of field service and tests, with charts and graphs of test results . . . plus 36 pages of technical data to aid in specifying and installing the right cable for the job . . . have gone into Okonite Bulletin EC-463. Write The Okonite Company, Passaic, N. J.

4811

where there's electrical power . . . there's **OKONITE CABLE**

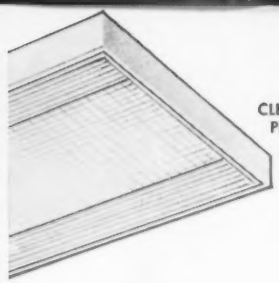
New from DAY-BRITE...

Daylume® makes the most of the merchandise in the Berglund Edsel showroom, Camden, N. J. F. HERBERT RADEY, A.I.A., *Architect.* JOHN T. PLASKET, INC., *Electrical Contractors.*

Quick facts about DAYLUME for Contractors

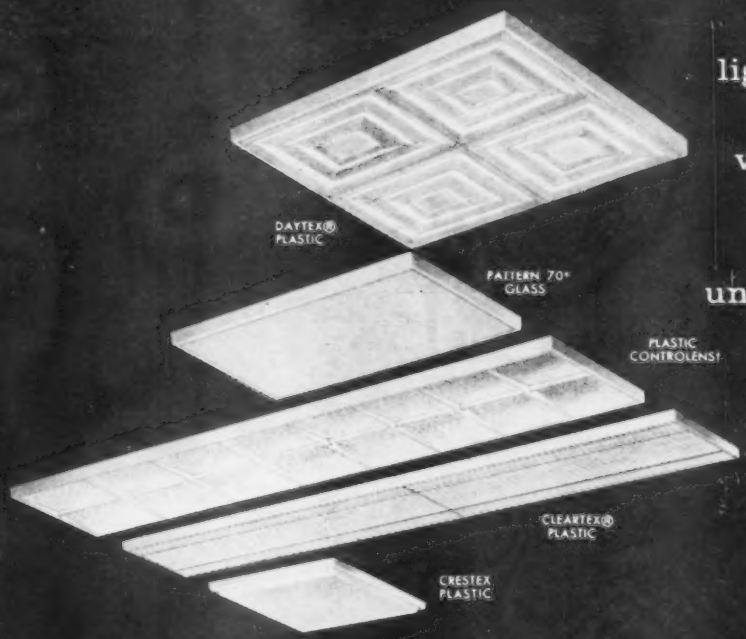
TO SPEED INSTALLATION, *Daylume* offers custom appearance with standard, quickly available units. Placement is not restricted by structural or mechanical components. Enclosures have "separable" hinges and may be hinged from either side. Can be wired through sides, center, or ends for end-to-end, side-by-side, or end-to-side installation. Recessed back plate design assures snug alignment with ceiling. Mounting straps with wing nuts make installation safe and easy. Glass enclosures are cushioned with vinyl gaskets to reduce breakage.

THINNER, LIGHTER, STRONGER *Daylume* fixtures are available in 6 sizes: 1′ x 4′, 1′ x 8′, 2′ x 2′, 2′ x 4′, 2′ x 8′, and 4′ x 4′ in two-, four-, six-, and eight-lamp arrangements of two- or four-foot lamps. In addition to those shown, enclosures also include glass and other plastic elements.



DAYLUME®

Surface Lighting Elements



Open new opportunities in lighting effects and effectiveness. Combine recessed appearance with surface-mounted flexibility. Only 3¼ inches thin for today's lower ceilings. Available in an unusual variety of enclosures and sizes for extraordinary light control and layout possibilities. All this plus Day-Brite quality—the standard of the industry!

*® Corning Glass Works †® Holophane Co., Inc.

For recessed lighting to match these enclosures, specify Day-Brite Mobilex®, Troffers and 4-Square fixtures.

LONG LIFE ASSURED. *Daylume* fixtures are rust inhibited and finished with Day-Brite hot-bonded enamel. All units are equipped with separately fused CBM ballasts for safety and ease in tracing electrical trouble. Frames have inner flanges for greater strength.

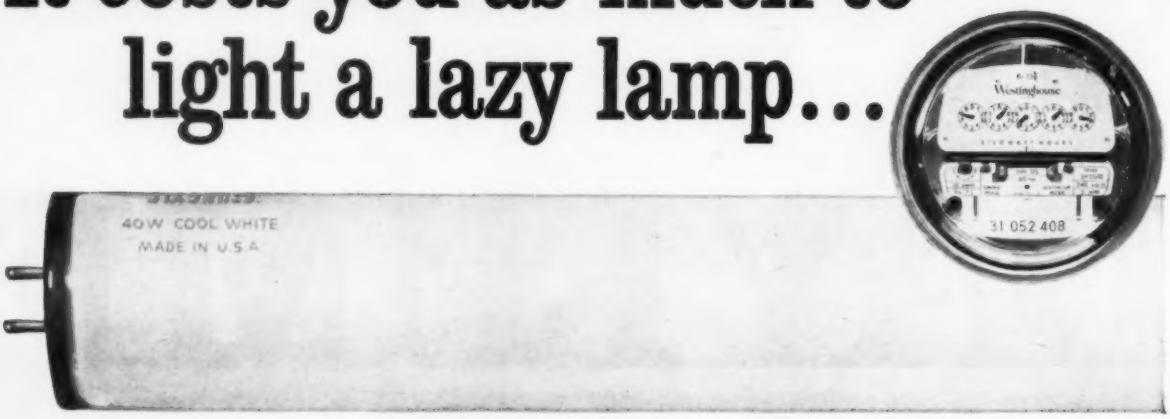
FOR FREE ILLUSTRATED BOOKLET on *Daylume*, call your Day-Brite representative listed in the Yellow Pages. Or write Day-Brite. Z-79

Day-Brite Lighting, Inc., 6248 N. Broadway, St. Louis 15, Missouri
Day-Brite Lighting, Inc., of Calif., 530 Martin Ave., Santa Clara, Calif.

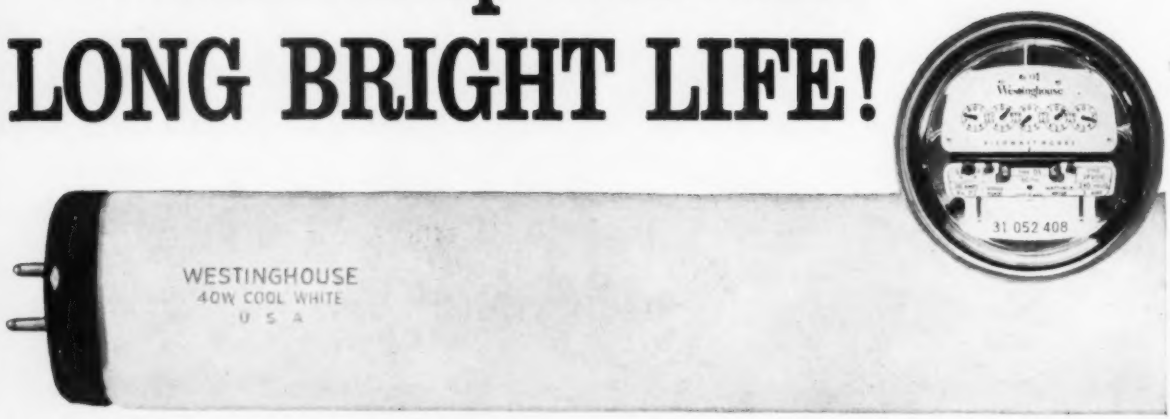
DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

It costs you as much to light a lazy lamp...



as a Westinghouse with "Ultralume" phosphors ...the lamp with the LONG BRIGHT LIFE!

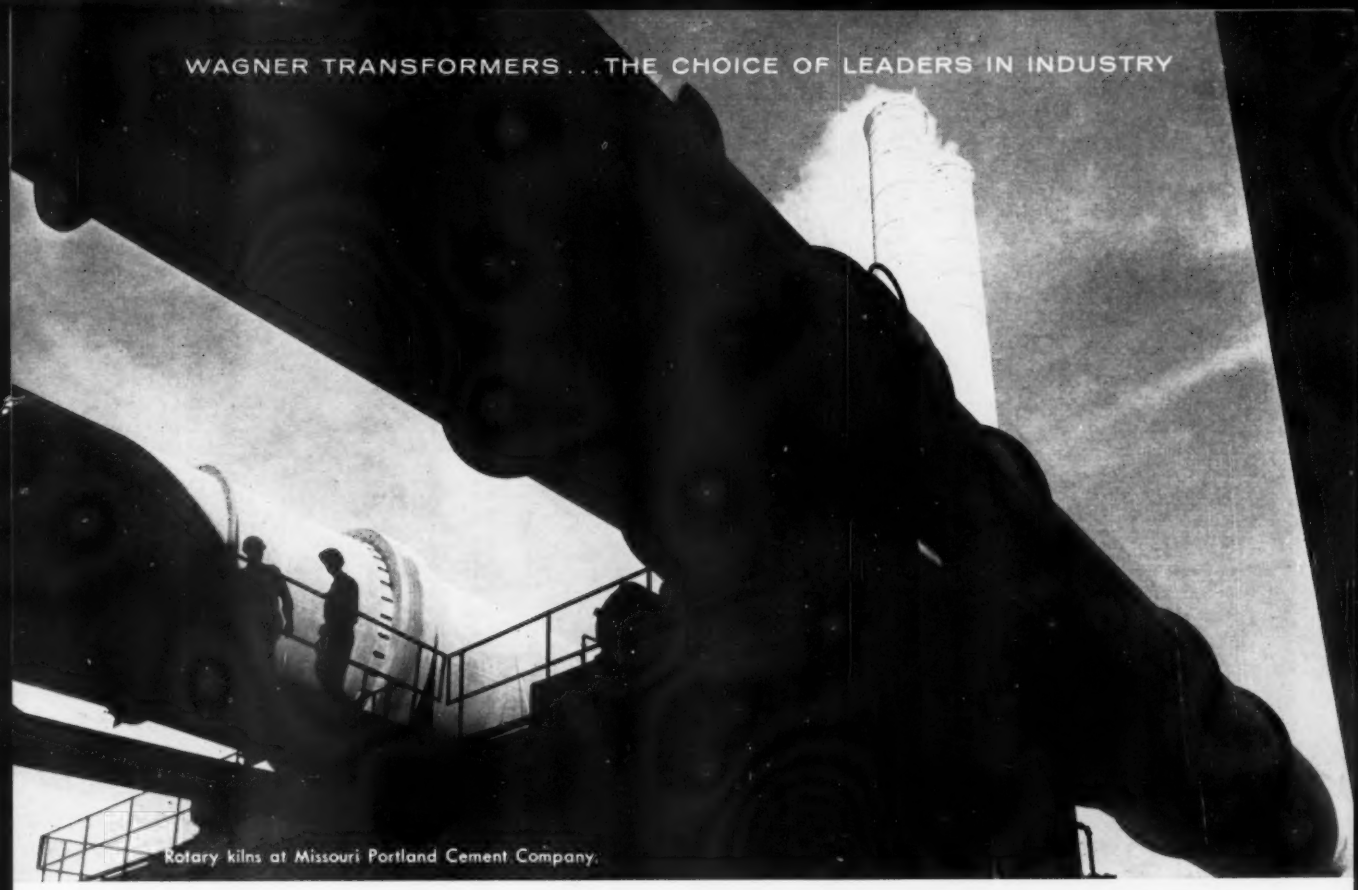


SOME FLUORESCENT LAMPS get "lazy" fast. They eat up the same amount of electricity, but grow dimmer fast. Only Westinghouse fluorescents stay bright as new . . . longer, because Westinghouse lamps have "Ultralume"™ phosphors!

"ULTRALUME" is an exclusive new Westinghouse phosphor that assures maximum brightness for the life of the lamp! "Ultralume" phosphors give you more light per foot of lamp, yet a Westinghouse costs no more to operate than any ordinary lamp.

ALL Westinghouse fluorescents have "Ultralume" phosphors . . . there's one for every business or home use. Specify Westinghouse on every lamp order. Call your local authorized Westinghouse agent or write—Westinghouse Lamp Division, Bloomfield, New Jersey.

Westinghouse (W) FLUORESCENT LAMPS



Rotary kilns at Missouri Portland Cement Company.

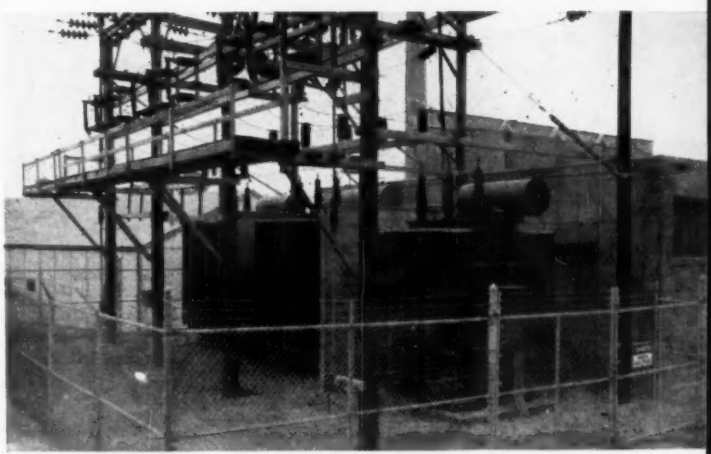
Missouri Portland Cement meets increasing power needs... provides for future expansion!

In 1949, Missouri Portland Cement Company completed a modern power distribution system to meet its demand for electricity. Its main substation provided 12,000 kva of transformer capacity—supplied by two Wagner Power Transformers—which could be raised to 16,000 kva by the use of cooling fans. The system also included five unit substations—powered by Wagner Unit Substation Transformers.

Since that time a need for increased production brought about the installation of a third rotary kiln, and even 16,000 kva was inadequate.

This pressing need for power was met by the addition of a third 6000/8000 kva Wagner Power Transformer, and by an additional Wagner Unit Substation Transformer for the load-centers.

Wagner Power and Unit Substation Transformers can meet your power needs just as they do at Missouri Portland Cement Company. Ask your nearby Wagner Sales Engineer to help you plan for your power needs. Call the nearest of our 32 branch offices, or write us.



TRANSFORMER TRIPLETS . . . BORN 8 YEARS APART

These three Wagner Power Transformers in the main substation at Prospect Hill, are identical—although the third unit was built eight years after the first two. They meet the tremendous demand for a dependable flow of power for Missouri Portland Cement Company.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

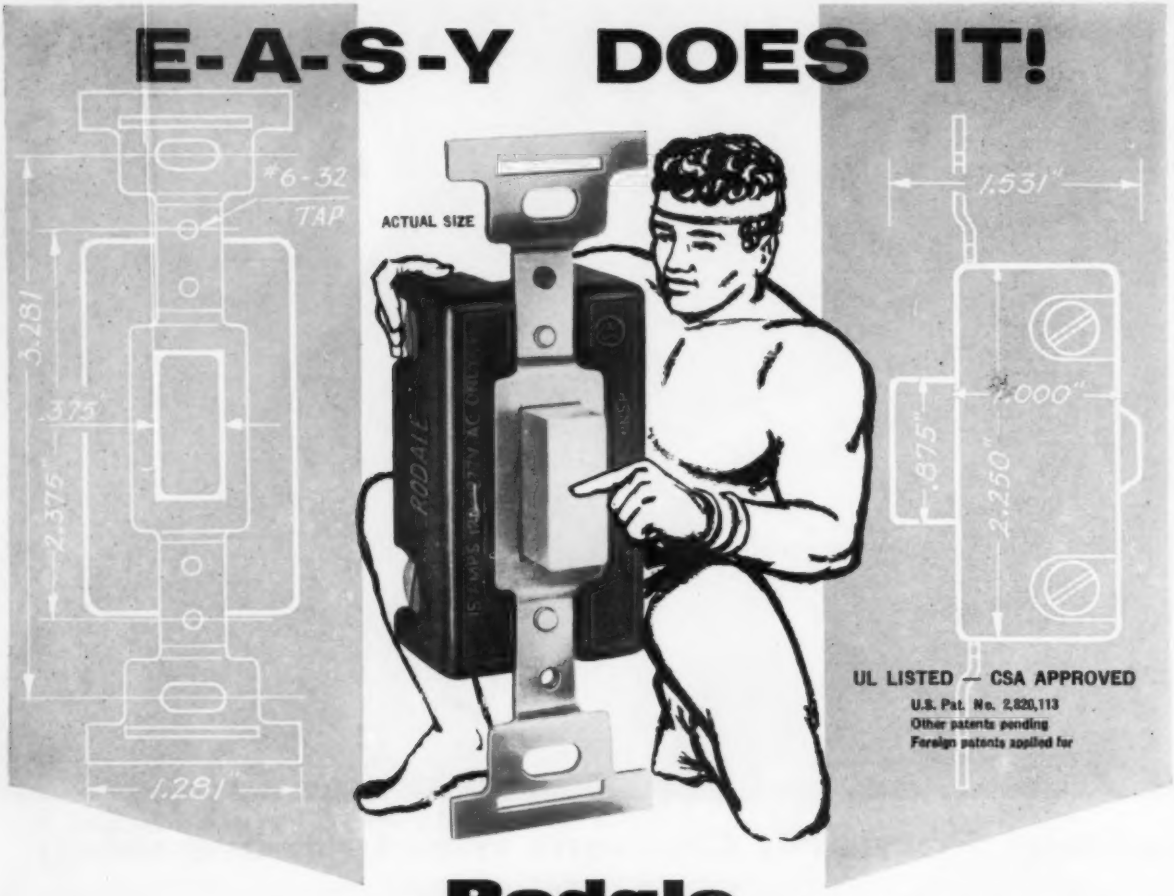
WT58-4

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

E-A-S-Y DOES IT!



UL LISTED — CSA APPROVED

U.S. Pat. No. 2,820,113
Other patents pending
Foreign patents applied for

Rodale

Sets The Pace With The

E-A-S-Y ACTION... E-A-S-Y TO INSTALL

"B" Touchette®

No knob to turn. No toggle to flip. Now, there's a switch designed for today's *push-button living*. It's "B" Touchette, the touch switch with feather-light operation. Not only that . . . but when you specify Touchette for new construction or remodeling jobs, you have easy installation, as well. Touchette measures just *one inch* in depth . . . allows for quick, simple installation . . . even in boxes where several wires enter.

Touchette needs no special wiring . . . fits standard outlet boxes and toggle wall plates and operates on full line voltage. Rated 15A—120—277V, it withstands motor loads up to 80% of rated capacity.

All these features . . . and "B" Touchette is the least expensive touch switch on the market!

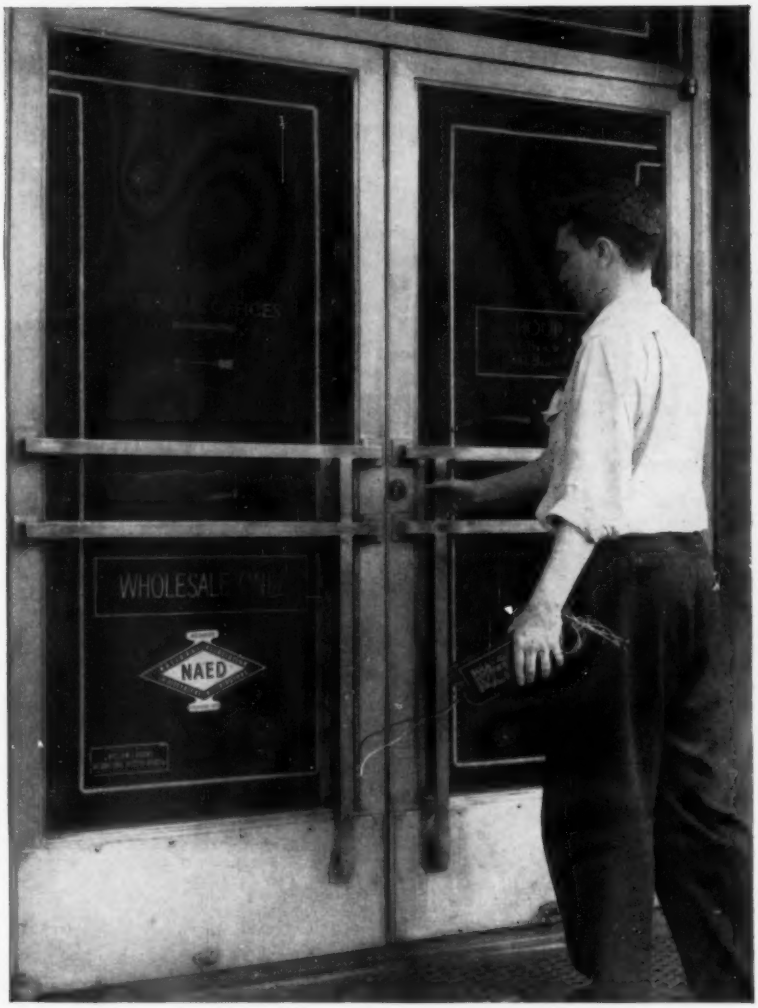
Available in single pole, double pole, 3-way and 4-way models. Brown or ivory touch button.

Sold only through electrical wholesalers.
Or for further information and prices, write: CM-2

Rodale manufacturing co., inc. emmaus, pa.

Immediate, free replacement for any defective-in-warranty Sola Fluorescent Ballast

Qualified wholesalers all over the U. S. A. provide this service, with no red tape, no delay, no cost or obligation of any kind!



If your regular electrical wholesaler stocks certified CBM ballasts for over-the-counter sale, he can give you an immediate, *free* replacement for any defective-in-warranty Sola fluorescent ballast you bring in.

Your wholesaler is able to provide this free service through a special arrangement with the Sola Electric Co., *even if he does not stock Sola ballasts.* Sola has authorized him to give you an equivalent certified CBM replacement of another make if necessary!

Since actual records show that Sola ballasts have an unusually low failure ratio (chances are 714 to 1 against in-warranty failure of a Sola ballast), you'll rarely, if ever, find occasion to take advantage of this service. Should the need arise, however, feel free to call on any local wholesaler authorized as a Sola Ballast Service Center, for a free replacement from his stock.

Send for Cross Index Ballast Chart:

Free chart lists Sola fluorescent ballasts and certified CBM equivalents, and shows you how to quickly and easily determine if a Sola ballast is in-warranty. Folds to 8½" x 11", is pre-punched to fit your standard 3-ring notebook.

SOLA Electric Co.
4633 W. 16th St., Chicago 50, Ill.
Bishop 2-1414

TO: SOLA ELECTRIC CO.
4633 West 16th St., Chicago 50, Ill.

Please send me, without any cost or obligation, the "Sola Cross Index Ballast Replacement Guide."

My name_____

Company_____

Address_____

City_____ Zone_____, State_____

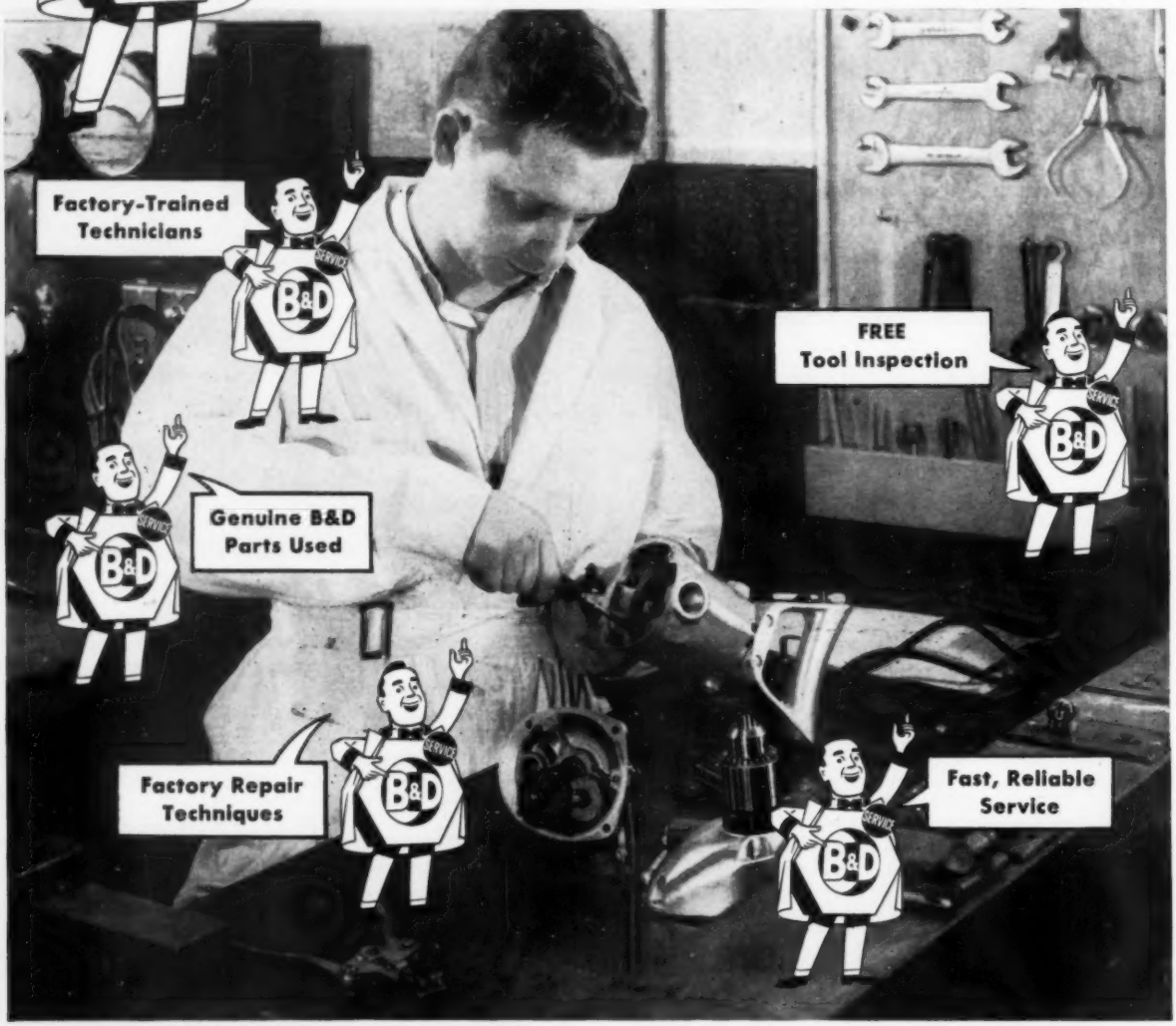
My regular wholesaler:_____
wholesaler's name

_____
wholesaler's address

Let the men who make 'em—fix 'em

Swifty Service says: "Local Black & Decker Factory Service Branches keep B&D Tools in new tool shape."

Your Black & Decker Factory Service Branch was set up to give you the *fast*, expert help we pledged when you first chose Black & Decker. There's quick, economical service available near you — no need to return your tool to the factory. Get your tool back on the job faster by bringing it in to any one of our 48 Service Branches. Our factory-trained technicians will give your tool a *free* inspection. The B&D Standard Guarantee applies on all repair work. See the phone book *Yellow Pages* for the B&D Service Branch nearest you, or write for address: THE BLACK & DECKER MFG. CO., Dept. S3102, Towson 4, Maryland.



There's a B&D Service Branch near you

ALA. Birmingham	IOWA Des Moines	New York	TEXAS Dallas
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CAL. Los Angeles	LA. New Orleans	N.C. Charlotte	San Antonio
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ALL-GLASS FRONT WALL of parabolic-arched entrance hall gives bright welcome to travellers arriving by car, cab or bus. Concealed uplighting units deliver 37 footcandles to under side of roof, while variety of downlighting mediums highlight sidewalk, threshold vestibules and interior floor of terminal building.

Illumination and power plan for 2300-foot Arrival Building at . . .

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. . . features wide variety of up- and down-lighting combining mercury-vapor, fluorescent and incandescent sources; pre-set dimmer-regulated clock-operated lighting patterns; high-frequency carrier-current electronic control; dual high- and low-voltage distribution; automatic emergency transfer switches; and an elaborate alarm annunciator that monitors all critical electrical equipment.

By Claude E. Sanford, P. E., & S. Leo Perlstein
Project Design Supervisor & Electrical Designer, The Port of New York Authority

NEW YORK International Airport's $27-million Overseas Arrival Building is a 3-story structure that houses Federal Customs, Immigration and Public Health departments. Together with two flanking wings that provide operational space for 14 foreign-flag airlines, this massive 3-unit structure has an overall length of 2300 ft (equivalent to 11 city blocks) and a gross floor area exceeding 14 acres.

Area application is understandably varied, for the buildings contain complete facilities for foreign-passenger reception, examination, communication, ground transportation, banking, eating, ticket sales, office routines and related services.

This variance in space application logically justifies an equally

variable lighting plan. And, since lighting mediums were also designed to complement contrasting architectural features, the resulting illumination installation reflects the influence of such design factors as aesthetics, appropriate brightness ratios, luminaire efficiency, ease of maintenance and safety.

Perhaps the widest assortment of lighting techniques is to be found in the vast entrance parabola, where designers were faced with the problems of a high (45-ft) parabolic-arched ceiling, a peripheral mezzanine, all-glass walls at the open ends, and glass panels across lower sections of both sides to provide an illusion of a floating structure.

Because these expansive glass areas presented a marked contrast between the dark underside of the ceiling and the sometimes-intense natural light of the sky, it was evident that special lighting treatments would be necessary to eliminate eye discomfort due to this wide brightness ratio.

This problem was solved by directing light upwards onto the underside of the ceiling, using 250 500-watt R40 lamps as the source of projected light, placing lamps every eight in. along the ends of the arched ceiling 2 ft. below ceiling-wall intersection lines, and concealing these lamps by a series of special anodized aluminum troughs.

Group Adjustment of Up-Lights

These troughs are 7 ft long and are mounted on 8-ft centers, each trough containing ten spotlamps mounted in cast-aluminum housings, alternately mounted on common horizontal shafts (i.e., five lamps per shaft) and with shafts rotatable within a 10-degree arc to permit accurate group-aiming and to obtain uniform light distribution on the sloping ceiling surfaces. This adjustment feature was incorporated into the trough design to compensate for lamp variations and structural tolerances.

With this intense illumination on the underside of the ceiling, daylight exterior-interior contrasts are now hardly noticeable to the casual spectator.

Exterior areas of the arched ceiling (outside the confines of the all-glass walls) are likewise lighted from below by means of special ground-buried 300-watt PAR medium-flood lamps; these lamps being mounted in cast-aluminum weatherproof housings which are suitably baffled and shielded by shrubbery to conceal their presence. Two lamps are grouped at each ground-buried mounting box, and mounting boxes are spaced along the entire width of the building on 8-ft centers.

In addition to this uplighting treatment, down-lighting is also provided by 200-watt low-brightness Alzak-aluminum recessed units which are spaced over the entire curved ceiling area on a uniform 8- by 10-ft pattern.

With this scheme of dual-source up-lighting, the arched "off-white" ceiling receives an average of 37 fc of illumination directly, while bounce-light from this single uplighting medium alone provides a 12-fc lighting component at floor level.

In addition, however, the recessed downlighting delivers an average of 15 fc, so that general illumination at floor level, obtained from both of these artificial lighting sources, has a maximum intensity of 27 fc during hours of outside darkness. Of course, due to the unusual expanse of glass wall surfaces, total illumination within the building during daylight hours is considerably greater than these after-dark values.

Contour-Tailored Downlights

Each horizontal row of downlights was specially tailored to conform with the contour of the ceiling at the particular elevation, so that the axis of all lamps and reflectors are vertical, and so that cutoff angles of shielding baffle plates are uniform for all sections of the parabola. Due to mounting heights, structural framing details and limited clearances between the outer roof shell and the inner suspended ceiling, the normally desired feature of top-access maintenance had to be abandoned, and, as now installed, the units are open-bottom fixtures which are relamped and maintained by men working from atop high-lift hydraulic-boom service cages.

Downlights of a different type are also used to highlight and

HIGH CEILING (45 ft) of entrance hall is uplighted by 250 500-watt lamps placed on 8-in. centers in troughs located at either end of arched roof. Alternate lamps are mounted on common horizontal shafts which may be rotated within 10-degree arcs to permit group-aiming and thereby obtain uniform light distribution on sloping ceiling surfaces.

FACADE OF ARRIVAL BUILDING is spanned by (1) row of side-mounted baffled downlights lamped with 300-watt PAR medium-floods, (2) 200-watt recessed units across the underside of the arched overhang, and (3) a continuous line of recessed fluorescent glass-panelled luminaires mounted between supporting columns of the entrance canopy.

dramatize the main entrance on the side facing the airport's 11-story control tower, for here a row of 34 side-mounted cylindrical baffled fixtures are lamped with 300-watt PAR medium-flood lamps, and are so aligned (12 ft above the deck, 4 ft on centers) that the major axis of all oval beams are parallel to the glass line of the front curtain wall.

The 3600-ft-long open observation deck is additionally illuminated by special fluorescent fixtures which are built into the deck rail. Lamps used are 6-ft T-12 slimlines spaced 8 ft on centers with each two lamps connected to a 2-lamp ballast which is likewise concealed within the railing between each pair of related lamps. The underside of this railing is tilted approximately 30 degrees from the horizontal so as to direct light inwards to the deck area.

Hinged access doors are faced with ribbed wire-glass diffusing panels, this medium providing a high-order of diffused illumination on the deck yet minimizing glare which might hinder the viewing of landing and departing aircraft during hours of darkness.

Two entry vestibules (one located at either end of this entrance) present still another lighting treatment, for these are illuminated by 6- by 20-ft luminous plastic egg-crate islands, each top-lighted by 15 T12 6-ft slimline lamps.

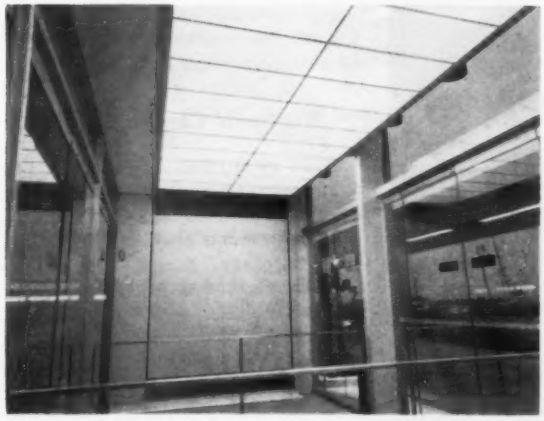
Airline ticket counters (located within the parabola beneath side mezzanines) are illuminated continuously by end-to-end-mounted recessed 3-lamp 2- by 4-ft eggcrate-louvered fixtures having 40-degree shielding in both directions. Louvers are finished in light grey to minimize specular reflection, while illumination delivered to counter tops from this continuous source approximates 70 fc.

Wherever practicable, fluorescent lighting is operated at 277 volts, being fed and controlled from 480/277-volt, 3-phase, 4-wire panelboards.

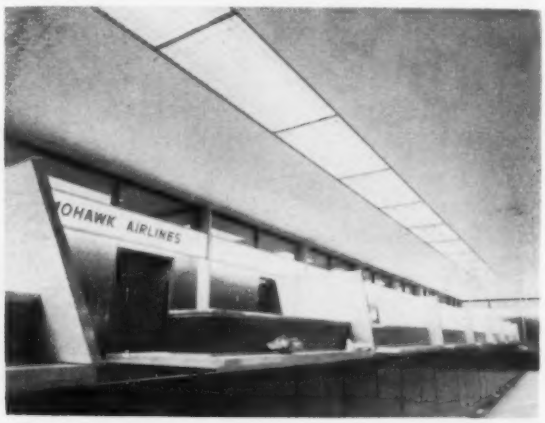
FEDERAL CUSTOMS AREA, measuring 644 by 80 ft, is illuminated by wall-to-wall luminous ceiling that is backlighted by 29 rows of slimline lamps extending the full length of this vast baggage-inspection area. Rows of lamps, operating at 200-ma, are alternately circuited so that intensities may be either 50-fc, or approximately half that amount. Due to relatively high mounting of lamps above the translucent panels, ceiling brightness remains fairly uniform even under reduced-intensity conditions.

Five Illumination Levels

It is of added interest to note that all uplighting, plus main-entrance facade downlighting, is regulated through motor-operated auto-transformer dimmers having



ENTRY VESTIBULES are surmounted by 6- by 20-ft plastic eggcrate-louvered panels top-lighted by 6-ft slimline lamps mounted on 15-in. centers. Ventilation of vestibules is via louvered ports at either side, while temperature of air is regulated by separate thermostats. General illumination inside the terminal after dark is 27 footcandles.



TICKET COUNTERS are continuously illuminated to intensity of 70-fc by 3-lamp eggcrate-louvered fixtures having 40-degree shielding in both directions. Specular reflection is minimized by light grey finish of louvers. These fixtures (as well as the majority of all public-area fluorescent installations) are operated at 277 volts.

45-second travel periods (from full brightness to blackout). Dimmers are remotely lever-operated from a master control panel having a 5-stage pre-set arrangement to permit the variation of interior lighting in accordance with existing daylight and with the prevailing volume of passenger traffic moving through the terminal at the time. These five preset patterns provide (1) minimum brightness sometime after midnight, (2) a slightly higher level just before dawn, (3) maximum brightness during the morning when traffic is more intense and daylight is fully developed, (4) a slightly lower intensity as dusk approaches, and (5) a midpoint illumination level for early evening hours when normal traffic begins to taper off.

Sequencing of the pre-set mechanism is normally activated by an astronomical time switch, although changes of time intervals and preset levels can be manually adjusted if so desired. Since a master fader and time-delay device is also provided (with transitional periods from one preset pattern to another lasting up to five minutes in length), the gradual adjustment of brightness levels can be accomplished practically without notice.

This 5-level provision obtains several desirable psychological objectives, since the greatest amount of light (artificial and natural, combined) is present when most people are occupying the parabola, thereby stimulating faster movement of traffic and business tempos; while reduced lighting levels at night, when only a few people are in the lobby, creates a more friendly and home-like atmosphere.

While downlighting is not regulated through dimmers, it, likewise, is controlled by an astronomical time switch and a 48-hr cycle timer that actuates contactors in a manner that turns all lights on at dusk each night, then turns half of the lights off around midnight, a different "half" being turned off on successive nights so that all lamps receive the same overall usage, diminish in light-output uniformly, and therefore age equally to justify and simplify a group-replacement policy.

Directly behind this arched-roof entrance parobola lies a 644-by-80-ft high-ceilinged Federal Customs area (largest single service area at the terminal) where incoming passengers are processed through the required entrance formalities on the main floor, while friends meeting them can observe the proceedings from a glass-enclosed mezzanine-level concourse.

Luminous Ceilings

This entire area is illuminated by a wall-to-wall luminous ceiling which is suspended above the main floor at a height of 24 ft and which is backlighted by 29 rows of slimline lamps spaced on approximately 2-ft centers and extending for the full length of this vast area. Lamps operate at 200 ma and, with all lamps in service, illumination at inspection levels is 50 fc maintained. If desired, this level of illumination can be reduced by switching off alternate rows of lamps, although, even under these reduced-intensity conditions, ceiling brightness continues to remain fairly uniform in appearance due to the carefully-designed distances between rows and between lamps and the translucent panels.

Diffusing medium for the ceiling is corrugated vinyl sheeting supported by anodized aluminum tracks run lengthwise through the building. This luminous ceiling is interrupted every 20 ft by a 2-ft-wide separator strip containing all air conditioning diffusers, return air grilles and loudspeakers for the P-A system.

Two additional adjacent areas (Public Health and Immigration) are likewise illuminated by this same type of luminous ceiling. And, in the three ceilings combined, lengths of fixtures total five miles while gross area of translucent panels exceeds 60,000 sq ft.

Completing the lighting plan for this Overseas Arrival and Departure area, aircraft aprons are floodlighted by arrays of both incandescent and mercury-vapor reflector lamps mounted on aluminum poles located on the observation deck approximately 200 ft on centers. Each pole is equipped with six 500-watt R40 incandescent floods plus three 400-watt R60 mercury-vapor reflector lamps, all lamps being of the outdoor type mounted in cast-aluminum housings.

OPEN OBSERVATION DECK, extending 3600 ft overall, is lighted by special fluorescent fixtures incorporated in railing. Slimline lamps (as well as related 2-lamp ballasts) are mounted behind wire-glass ribbed diffusing panels which are tilted inwards to direct light to deck surface.

Electronic Carrier Control

It is of further interest to note that both manual and automatic operation of area and sign lighting (as well as the operation of motor starters, fans, pumps, unit ventilators and thermostatic controls) is accomplished, without special wiring, by transmitting high-frequency electronic carrier currents over the standard 60-cycle electrical distribution system.

Two types of signal generation are utilized in the Arrival Building: rotary generating components consisting of a frequency generator, exciter and drive motor; and tube-type equipment incorporating

an oscillator, amplifiers, power supply and output stage.

In the first type, generator output through its various controls is capacitively coupled to the electrical distribution system, a dual-frequency generator being connected to the 4160-volt primary system in this instance to provide two carrier-current frequencies, at 2340 and 3218 cycles, for use throughout the entire 655-acre airport site.

In the second type of generation, the output stage, consisting of transformers and coupling capacitors, connects the selected frequency into power distribution systems where voltage is below the 600-volt level. In this case, transmitters and amplifiers are connected to the 480/277-volt system at two locations within the building, while the system furnishes four separate carrier-current frequencies at 11, 13, 16 and 19 kilocycles.

Approximately 180 individual electrical functions can be controlled automatically or manually through the use of IBM dual coded relays tuned to specific coded impulses. Relays are installed adjacent to lighting panel contactors, motor starters and so on, one relay frequently controlling more than a single motor or device. Relays are directly connected to the electrical units they control, momentarily providing a path for connecting electrical power to turn the unit on or off. Since there is no limitation as to the number of circuits which can be applied to any specific code, unlimited expansion of these control functions is possible.

Central control point for this electronic carrier system is located in the watch engineer's office, where a radio-supervised master time control is electrically connected to four central operations panels (with provisions for the installation of a fifth panel), each panel containing 36 circuits.

Radio Synchronized Operations

Synchronizing time signals (broadcast from the National Bureau of Standards) are received by the radio control unit, a tuned whip antenna being mounted atop the Arrival Building for that purpose. Since the rated accuracy of this radio time control is within one second per day of exact time, all of the pre-programmed functions regulated by the operations panels are automatically turned either on or off with that degree of exactness. Of course, in addition to predetermined programmed times of operation, any individual circuit's on-or-off performance can be controlled manually from this central location.

While the primary consideration for the installation of this electronic carrier-current system was the automatic control of utility functions, synchronized clock control was additionally realized. All clocks connected to the 110-volt secondary electrical power system are therefore checked by this means on an hourly basis, while, at 6:00 am and 6:00 pm each day, any clock which may have become inaccurate due to interruption of power will be automatically reset.

Four Primary Services

Power for the building is presently provided through two 2000-kva double-end-feed substations located on the second floor approximately 800 ft apart. Should additional power be required at some future date, provisions exist for the installation of a third station of like size. The four transformers now in service are 1000-kva askarel-filled self-cooled wye-wye grounded-neutral units, with each high-voltage winding having four 2½% full-capacity manually-changed taps on the high side of 4160 volts.

All feeders enter the building underground via separate manhole-and duct routes, the four feeders forming part of a high-voltage distribution network that serves the entire airport.

Two of these primary feeders (normal and emergency) enter each substation through a 5-kv primary switchgear cubicle that contains a hydraulically operated transfer unit having 400-amp, 3-pole load-break gang-operated interrupter switches equipped with disconnecting-type power fuses rated for 180,000 kva at 4160 volts. Transfer of load from normal to emergency service is automatic in the event of an interruption in the normal feeder, while re-transfer occurs as soon as normal service is restored. Closing both switches simultaneously is prevented through the installation of interlocks, while remote supervision of primary (and also secondary) status is possible due to the installation of auxiliary switches mechanically connected to primary operating mechanisms.

FLOODLIGHT POLES mounted every 200 ft along edge of observation deck support nine units each; six 500-watt R-40 incandescent and three 400-watt R-60 mercury-vapor reflector lamps. Poles and lamp housings are cast-aluminum, while multi-circuiting permits using the various light sources either separately or conjunctionally.

On the low-voltage side (480/277-volt), each transformer is bus-connected to a main- and tie-breaker compartment, plus six secondary feeder circuit breakers. All switchgear is free-standing self-contained metal-enclosed construction, with bus and cable connections located in full-height rear-access compartments. Bus structures are insulator-supported; have silver-plated joints, and are equipped with solderless-type secondary feeder lugs.

All main- and tie-breakers are 3-pole, 1600-amp manually operated draw-out units equipped with dual magnetic overload attachments and rated for IC's of 50,000 amps. Branch breakers are similar in construction but have normal current-carrying capacities of 600 amps and short-circuit interrupting capacities of 25,000 amps. All break-

ers of equal rating are interchangeable, and all individual breakers are automatically tripped when cubicle doors are opened or when breakers are withdrawn for inspection or maintenance.

Automatic Transfer Switches

Just as primary service is insured through the existence of both normal and emergency 2400/4160-volt feeders, so many of the secondary circuits (related to such essentials as lighting for corridors, stairwells, public areas and exit signs, plus power for the fire alarm system and watch engineer's panel) are likewise protected through the existence of (1) tie feeders between the low-voltage (480/277-volt) sides of both substations, (2) normally open tie breakers in this cross-connecting hook-up, and (3) automatic transfer switches that shift load back and forth between normal and emergency sources of power when "preferred" power is either interrupted or restored.

These automatic transfer switches are 600 amps, 750-volt, 3-pole solid-neutral non-fusible double-throw units operating in either direction independently of any external electrical operating mechanisms or control circuits. Operation is initiated by single-coil momentarily-energized devices which are integrally interlocked both mechanically and electrically, and which are electrically energized by the source *to which* the emergency load is to be transferred.

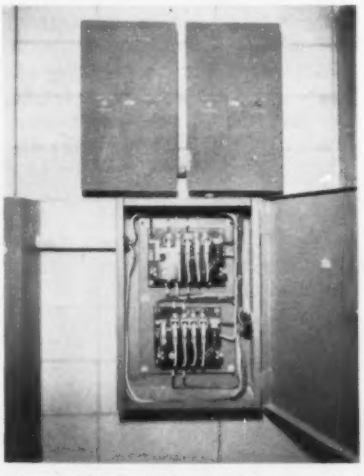
Bus Ducts and Cable Trays

Distribution, between substations and the two flanking wings occupied by the 14 foreign-flag airlines, is essentially via 480/277-volt, 3-phase, 4-bar enclosed plug-in busduct runs designed to withstand the electro-magnetic stress resulting from a 25,000-amp symmetrical short-circuit condition. Two such busduct runs serve each wing, each run being separately cable-connected to a 600-amp substation secondary breaker cubicle, and each run being sectionalized by intermediate breakers which are fused to progressively reduce the current-carrying capacity of these sections from 600 to 400 to 225 amps.

Tenant locations in both wings are normally supplied through plug-in breaker units connected to these ducts, while metering is via equipment located on the premises of these several tenants. Separate circuits to each tenant's space also provides emergency service for essential public-area and exit lighting.

Within the main Arrival Building, distribution (normal and emergency service alike) is via non-magnetic cable trays located in the building's crawl space, this method of routing being selected in the interest of accessibility for circuit inspection, maintenance, changes or additions.

Low-voltage (480/277-volt) distribution panels are applicable for either 3- or 4-wire circuiting, the majority of larger motors operating at 480 volts; while fluorescent lighting in all major areas operates at the 277-volt level. Where 120/208-volt (or 120/240-volt) power is required for the operation of smaller motors or for lighting in local areas of the building, dry-type transformers are installed locally to provide this order of service. These low-voltage panels and transformers are conveniently grouped together in electrical equipment rooms, while all transformers and motors are insulator-mounted to minimize vibration.



CONTACTORS AND RELAYS in typical lighting panel are wired by decal-identified neatly-skeined conductors. Terminals are likewise stenciled to insure proper connections, while all replaceable parts have serial numbers inscribed thereon to guarantee exact duplication. Relays are operated by electronic high-frequency carrier currents, while five different levels of lighting may be obtained through action of remote dimmers and pre-set brightness sequencing mechanisms.

Phased Branch Breakers

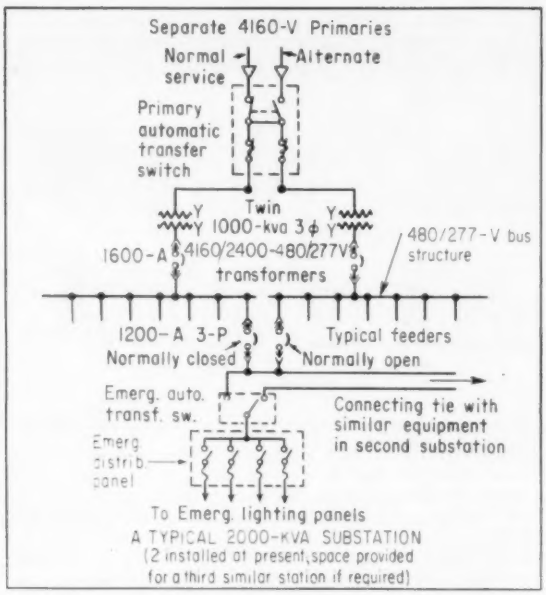
In all local 3-phase panels, single-pole breakers for branch circuit control are paired and sequenced; that is, breakers 1 and 2 are connected to phase A, 3 and 4 to phase B, 5 and 6 to C, 7 and 8 to A again, and so on. Therefore, when 2- or 3-pole breakers are required, they may be substituted directly for adjacently arranged single-pole breakers on either side of the panels.

Local wiring is color-coded for identification and is run in conduit which is supported variously by straps, clamps or hangers secured by welded stud bolts, expansion bolts or lag screws depending upon conduit location and whether the supporting surfaces are metal, concrete, masonry or wood. Where conduits cross structural joints, they are equipped with standard expansion fittings. And, where non-rigid connections are required in wet or damp locations, such connections are effected via liquid-tight flexible conduit. When carried underground, conduits are securely supported and sheathed in concrete envelopes, joints being staggered and spare extensions being stubbed, capped and coated with bitumastic paint pending their subsequent use.

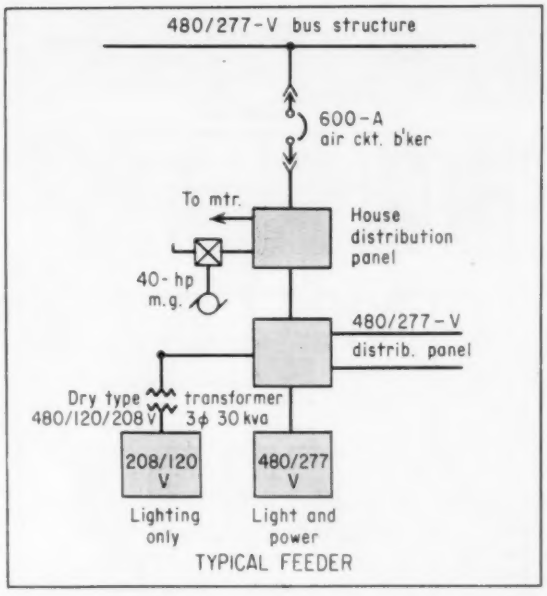
Grounding of the electrical system is both extensive and positive, with equipment-room buses and a building-wide grounding grid connected at numerous points to the water system and also to additional ground rods. This interconnection results in a maximum resistance-to-ground of 10 ohms. Connected to this grounding system are all metal enclosures for electrical devices, metal raceways and underground conduit, exterior street- and flood lighting poles and towers, interior lighting fixtures, cable trays and their supports, lead- or metallic-shielding for 4160-volt power cables, etc. Connections and lugs are generally solderless, although grounding cables are welded to rods driven in ground, and all buried connections are encased by multiple layers of plastic electrical tape.

Central Alarm Annunciator

To facilitate constant supervision of critical electrical equipment, a central alarm panel is installed at one of the substations to advise the watch engineer on the operational



TYPICAL SUBSTATION has separate underground 4160/2400-volt feeders (for normal and alternate service), automatic hydraulically operated primary transfer switch, twin 1000-kva transformers to reduce voltage to 480/277 level, separate secondary bus structures and emergency transfer panels related to critical light and power requirements. Note tie between transfer switch and second substation.



TYPICAL FEEDER arrangement indicates 480/277-volt 3-phase, 4-wire bus structure serving distribution panels through 600-amp air circuit breaker, with sub-feeders continuing on to motors, generators, other 480/277-volt panels (related to power and fluorescent lighting), or to dry-type transformers that step current to 120/208 volts for incandescent lighting and incidental power loads.

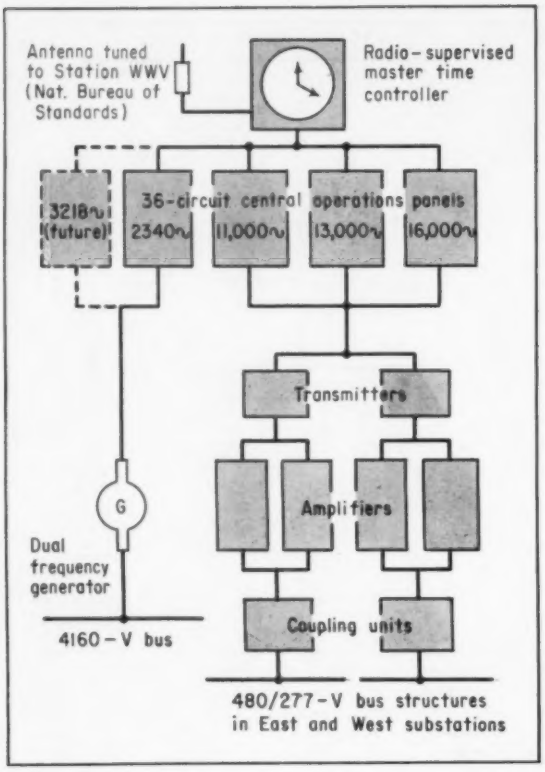
status of critical motors and lighting, the temperature conditions existing at numerous points throughout the buildings, and, previously mentioned, the high-frequency carrier-current control equipment. These panels are formed-steel walk-in units with interior illumination to promote safe and accurate inspection and wiring, and with fibre-tagged identification of all circuits.

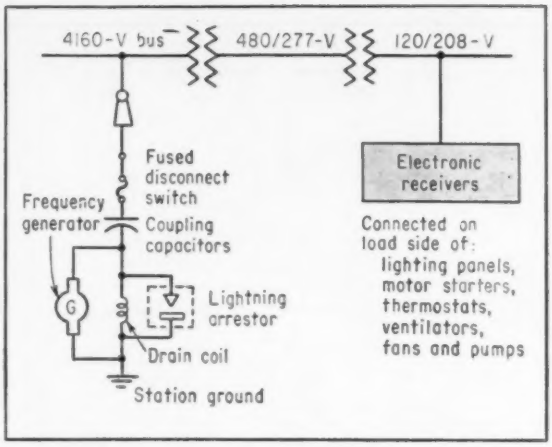
In the interest of monitoring accuracy, the panel is divided into separate sections for motors related to the CAA control tower and all exterior services, motors and pumps located within the building proper, alarms related to distribution system breakers, plus spare panels for possible future additions.

Motor sections have visual annunciators of the illuminated-message type with white translucent letters on a black background and back-lighting provided by two 3-watt white lamps so that positive identification is possible even if one of these lamps is burned out. Of course, when motors related to these signs are inoperative, the back-lighting is switched off completely and the message disappears.

Message-markers on a special trouble section are additionally backlighted by two red lamps so that, should any critically important device begin to operate abnormally, the identification plate would be doubly illuminated by red as well as by white, while the attention of the engineer would also be attracted by an audible alarm. This alarm (plus the white lamps) can be manually switched off by the engineer, although the red lamps remain burning until the trouble has been located and corrected. When conditions have returned to

PUBLIC ADDRESS system has central announcer's console containing push-buttons related to 53 separately-wired areas in the Arrival building, this arrangement permitting confinement of announcements and paging to selected areas (if so desired) without totally interrupting background musical transcriptions. Dissemination of music and announcements is via 17 70-watt power amplifiers and 600 loudspeakers.





ELECTRONIC CONTROL of lighting, motors, ventilators, fans, pumps and the like is obtained by high-frequency carrier currents impressed on the standard 60-cycle distribution system. Two types of signal generation are utilized; rotary components consisting of a frequency generator, exciter and drive motor; and tube-type equipment incorporating a frequency oscillator, amplifiers, power supply and outage stages.

CODED RELAYS (tuned to carrier-current frequencies of 2340, 3218, 11,000, 13,000 and 16,000 cycles control approximately 180 individual electrical functions at New York's International Airport. Relays are directly connected to the electrical units they control. Unlimited expansion of this high-frequency system is possible.

normal, the audible alarm again sounds while the white lettering reappears. Upon activation of a manual toggle switch, the alarm is again turned off and the white lighting only remains to illuminate the sign in question. Should *several* trouble alarms be registered simultaneously, the audible alarm will continue to sound until the above procedure has been completed with *all* of the affected annunciator stations.

Control wiring related to this panel approximates 40 miles of No. 14, this wiring being in addition to 100 miles of No. 16 connecting this panel and another central annunciator located in the airport's air conditioning and heating plant which is located about a quarter-mile distant from the Arrival Building.

Hi-Fi P-A System

Also included as an integral service function of this building is a "background music" and public-address system which was designed specifically to meet the requirements of the public and the various tenants occupying this high-ceilinged structure.

In public areas, reproduction of high-fidelity musical transcriptions and all announcements or paging calls are disseminated through 600 loudspeakers installed either behind perforated metal-pan ceiling panels or inconspicuous ceiling-matching speaker grilles.

Audio power for these speakers is supplied by 17 70-watt power amplifiers, while control of the system is from a central console located in an announcer's booth. Since the overall system is divided into 53 separately-wired areas in the building, it is possible to confine announcements and paging to selected areas without interrupting musical programs to the remaining sections of the terminal.

Design of this system also permits local microphones to utilize a portion of the amplifier power bank for local amplification, without interrupting the function of the system as a whole. These local microphones are located in Customs areas and along spectator decks, and inputs are so circuited that, in case of emergency, microphones located at police booths, ramp controller stations and in the superintendent's office would take control of the entire system, regardless of the switch positions on the control console at that time.

Credit for conceiving and creating these various features naturally includes an army of engineers too numerous to completely list. Special mention should be made, however, to contributions of architects Skidmore, Owings and Merrill; exterior design consultant Wallace K. Harrison; electrical contractors Fischbach and Moore, and J. Livingston; lighting consultant Richard Kelly, plus all branches of the Port Authority engineering staff headed by John M. Kyle, Chief Engineer; Irving P. Gould, Engineer of Design, and Henry W. Wenson, Jr., Electrical Engineer. P. A. electrical designers on this project included the authors plus Walter Faktor, Daniel Ferro, Robert Frey, Charles Johannis and Jacob Schmitzer.

The completion of this building, plus other structures already constructed or now-in-progress, raises the invested value of this 655-acre central-terminal nucleus to $120-million. And, since most of these structures are concentrated at the center of the huge field, completely surrounded by peripheral runways, the plan is a design innovation.

ESTIMATING FORUM - VIII

Operating Costs - Direct Job Costs Applied to Material and Labor

By Ray Ashley, Research and Consulting Engineer, Oak Park, Ill.

QUESTION:

Are direct job costs the same for material as for labor?

ANSWER:

No. The items of cost are not all common to both material and labor. Those that are common to both are not equally divided between the two.

DISCUSSION:

Items of direct job expense, common to most electrical construction work, are found in the accompanying table. There are three separate groupings —Material, Labor, Material and Labor. Bear in mind, while going through this discussion, that each job function in the table above is directly attributable to the heading under which it appears.

MATERIAL—There are three items listed as being confined strictly to material. Of these, only "purchasing" may be considered as being in no way concerned with Labor. Of the others, selection, follow-up and coordination of deliveries are definitely "occasioned" by material; but it is a well established fact that such functions are carried on to facilitate installation labor. Unless the proper types of material arrive on the job site on schedule, mechanics will have nothing to install and labor costs will rise.

LABOR—Listed under this heading in the table are such items as supervision, timekeeper and interest on payroll. These are unquestionably items of labor cost. Blue printing also falls in this category since the principal function of furnishing one or more sets of prints is to facilitate labor. Frequently shop drawings are issued to clarify complicated prints or to solve specific installation problems.

Some are of the opinion that tools are a material item. Unlike material, tools are not installed on the job. Their sole function is to increase the efficiency of the mechanic and to expedite labor. Direct job expenses related to tools is as much a labor item as the mechanic and his supervision.

MATERIAL AND LABOR—Under the heading of costs common to both material and labor are such items as engineering, drafting and inspection. While they may involve material, they are principally concerned with labor. This is particularly true of necessary field engineering and relevant shop drawings. Functions of this type are performed primarily to make it easier for the mechanic on the job to make the installation. While both material and labor may be involved in these items, cost division between the two may not be equal.

While we are likely to consider cartage a cost of material service, on some jobs the amount of cartage chargeable to labor is greater than that chargeable to material. Under existing practice, practically all of the material is delivered to the construction site by the jobber. On the other hand, tools—which are a labor charge—must be delivered to and from the job by the contractor. Hence it is quite possible that labor could be responsible for a major portion of a job cartage charge.

DIRECT JOB EXPENSES

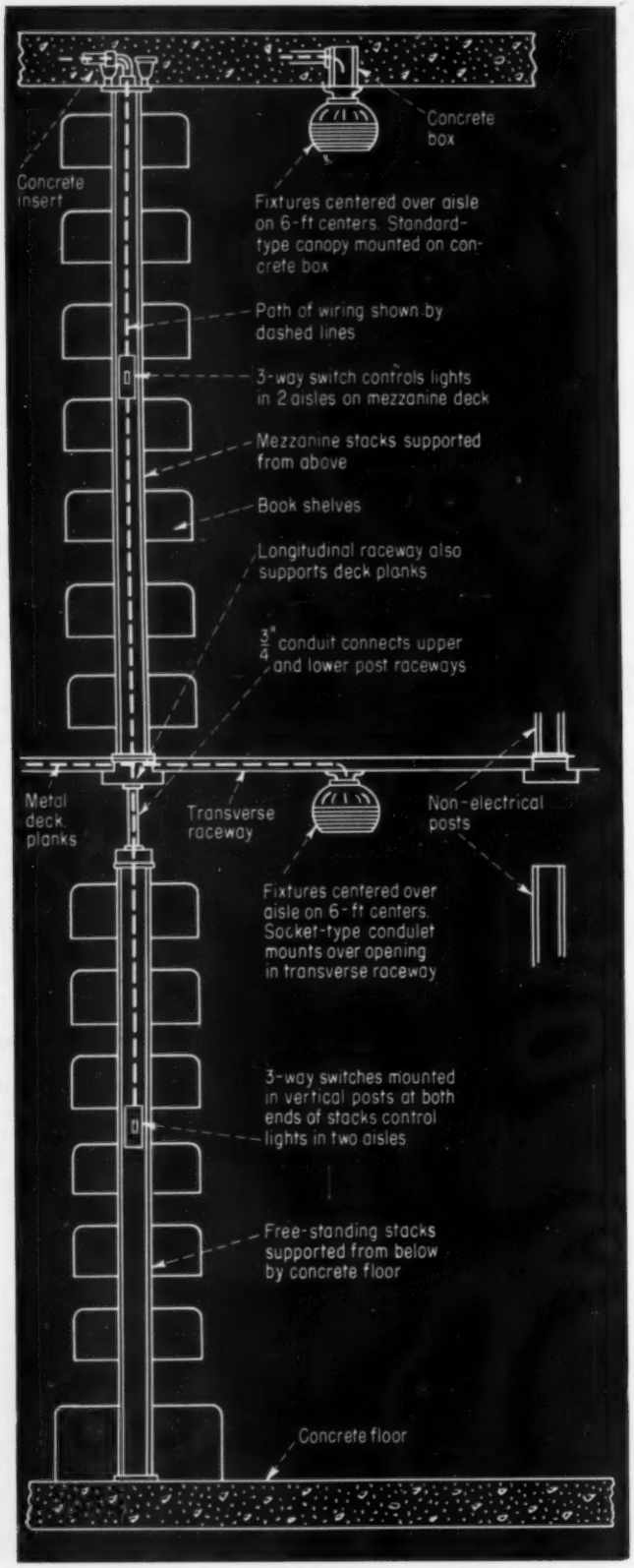
Expense items occasioned by Material, Labor and Combination of Both

Material	Labor	Material and Labor
Selecting	Supervision	Estimating
Purchasing	Tools	Engineering
Follow Up and	Timekeeper	Drafting
Coordinating	Blue printing	Cartage
Delivery	Interest on Payroll	Inspection

Note: For accurate estimating and cost accounting, job expenses must be charged to the item occasioning them. Tools and supervision must be charged to labor because their purpose is to facilitate labor.

CONSTRUCTION TOOLS AND MACHINES are definite items of labor cost. Trenchers, such as this, are purchased or rented and used to speed up installation and to increase efficiency.

Built-in


Concrete box
Concrete insert
Fixtures centered over aisle on 6-ft centers. Standard-type canopy mounted on concrete box
Path of wiring shown by dashed lines
3-way switch controls lights in 2 aisles on mezzanine deck
Mezzanine stacks supported from above
Book shelves
Longitudinal raceway also supports deck planks
3/4" conduit connects upper and lower post raceways
Metal deck planks
Transverse raceway
Non-electrical posts
Fixtures centered over aisle on 6-ft centers. Socket-type condulet mounts over opening in transverse raceway
3-way switches mounted in vertical posts at both ends of stacks control lights in two aisles
Free-standing stacks supported from below by concrete floor
Concrete floor

ELEVATION of mezzanine and free-standing stacks showing path of of conductors from concrete insert in slab to fixtures and switches.

A UNIQUE means of electric wire distribution is provided by shelving units used for book storage in the stack areas of the Morris Raphael Cohen Library on the south campus of the City College of New York in New York City.

Metal beams, floor plates and supporting posts were designed to double as raceways for the conductors required for lighting the stack areas. Book stacks are located on each of the three main floors of the library, as well as on three mezzanine floors which are supported by the stacks themselves.

The main vertical posts which support the shelves of the stack units were anchored to concrete inserts in the slab ceilings of the first, second and third floors. Longitudinal hollow beams were bolted to the bottom of the posts, connecting them together. Metal plates or planks were then laid across the beams to form a continuous "mezzanine" deck between the units. The interlocking method by which these deck planks are joined forms a transverse raceway between the beams.

Thus, raceways were established in three directions: down through the hollow vertical posts, longitudinally inside the deck beams between the posts, and transversely through the deck planks between the beams.

Similar free-standing stacks were constructed on the concrete floors directly below the suspended stacks. Short lengths of conduit were installed between the deck beams of the upper stacks and the conductor-carrying posts of the lower stacks to bring electrical circuits to the lower units.

Vertical posts used were of two

Raceway for Book Stack Lighting

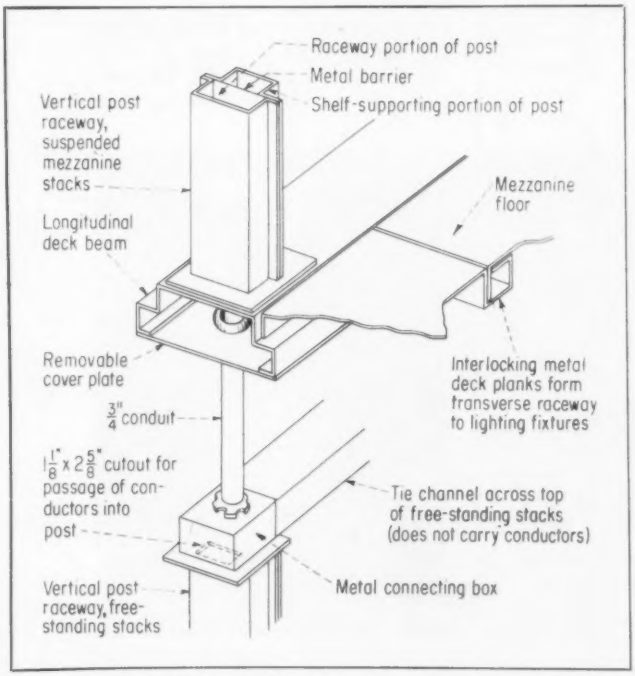
Sheet-metal ceiling-suspended shelving structure at new Morris Raphael Cohen Library in New York provides a network of passageways for distribution of electrical conductors.

general types: non-electrical and those doubling as raceways. Vertical baffles of 16-gage steel were installed in the posts designed to carry conductors to separate the wiring from the portion of the post which is perforated to support shelves and other structural members. Non-electrical posts are perforated on all sides and have no baffles.

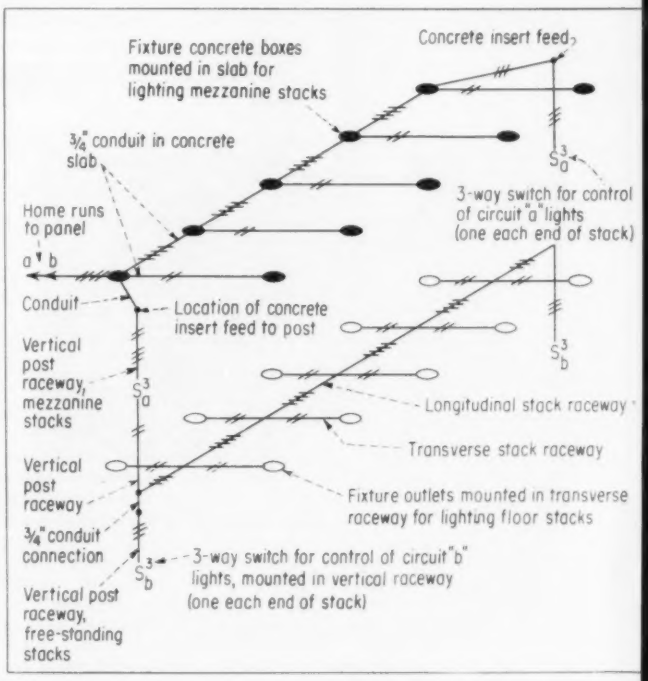
Lighting fixtures in the stack area are 60-watt incandescent units with prismatic glass enclosing globes. Those illuminating the aisles between the mezzanine stacks were mounted on concrete boxes cast into the ceiling, the boxes being fed by conduit inside the slab.

Fixtures lighting the lower stacks, although using the same type globe, are mounted to the transverse raceway of the mezzanine deck planks by means of a special Condulet incorporating the fixture socket. A pre-cut opening in the bottom surface of the raceway permits conductors to reach the fixture.

Home runs were carried from the panelboards to the stacks through conduit in the slab. Concrete inserts supporting the conductor-carrying posts were fabricated with a $\frac{3}{4}$-in. coupling welded to the center of the insert plate, to which a $\frac{3}{4}$-in. short elbow was fixed to receive the conduit from the panelboard. The metal plate was drilled to permit conductors to be pulled through the elbow down into the vertical posts. A short nipple was screwed into the coupling to cover the threads and to prevent damage to conductors in pulling.

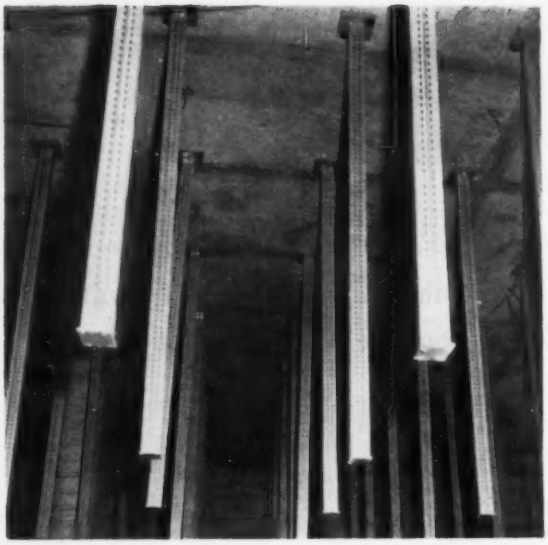

Raceway portion of post
Metal barrier
Shelf-supporting portion of post
Vertical post raceway, suspended mezzanine stacks
Longitudinal deck beam
Mezzanine floor
Removable cover plate
Interlocking metal deck planks form transverse raceway to lighting fixtures
¾" conduit
1⅛" x 2⅝" cutout for passage of conductors into post
Tie channel across top of free-standing stacks (does not carry conductors)
Vertical post raceway, free-standing stacks
Metal connecting box

STRUCTURAL DETAILS of stack framing members. Where conductor-carrying transverse raceway intersects deck beam (not shown), 1⅛-in. hole is drilled in side plate of beam to permit passage of wire into longitudinal raceway.


Concrete insert feed
Fixture concrete boxes mounted in slab for lighting mezzanine stacks
¾" conduit in concrete slab
3-way switch for control of circuit "a" lights (one each end of stack)
Home runs to panel
a b
Conduit
Location of concrete insert feed to post
Vertical post raceway, mezzanine stacks
Longitudinal stack raceway
Transverse stack raceway
Vertical post raceway
Fixture outlets mounted in transverse raceway for lighting floor stacks
¾" conduit connection
3-way switch for control of circuit "b" lights, mounted in vertical raceway (one each end of stack)
Vertical post raceway, free-standing stacks

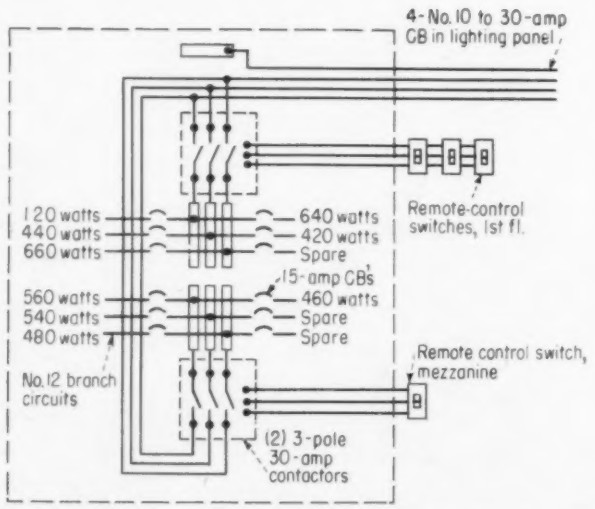
STACK WIRING in most cases consists of two No. 12 branch circuits, one serving mezzanine stack and the other the lower free-standing unit. Average load per circuit is ten 60-watt lamps, or 600 watts.

CONCRETE INSERTS in place above slab before pouring. ¾-in. conduit and elbow carry branch circuit wiring down to stack posts. After pouring posts were welded to underside of insert plate.



STACK POSTS after welding to inserts. Slots in posts permit mounting of book shelves at any desired spacing. Posts doubling as raceways afford continuous unbroken passage for conductors without slots, the raceway section being separated from the perforated sides by a vertical baffle plate.

REMOTE-CONTROL CONTACTOR PANEL FOR AISLE LIGHTS



Aisle and hallway lighting in vicinity of book stacks other than the lights over the stack aisles are remotely switched through the use of special contactor panels. The split-bus panel shown above, serving the first floor and first floor mezzanine, uses two 3-pole, 30 amps-per-phase contactors to feed the two bus sections.

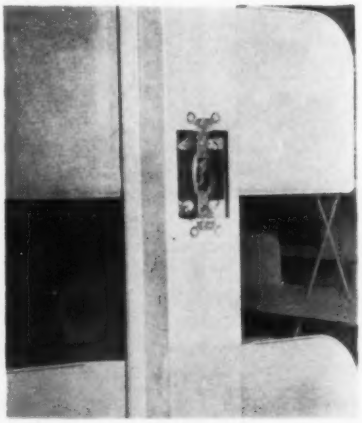
Main aisle areas are lighted by 60-watt prismatic glass fixtures identical to those used between the stacks; the elevator and stairway core is ringed by 20- and 40-watt single-lamp fluorescent units.

Remote control switches are located at heads of stairways, at elevators, or at other heavily travelled locations. First-floor switches control five circuits simultaneously; mezzanine switch controls four circuits.

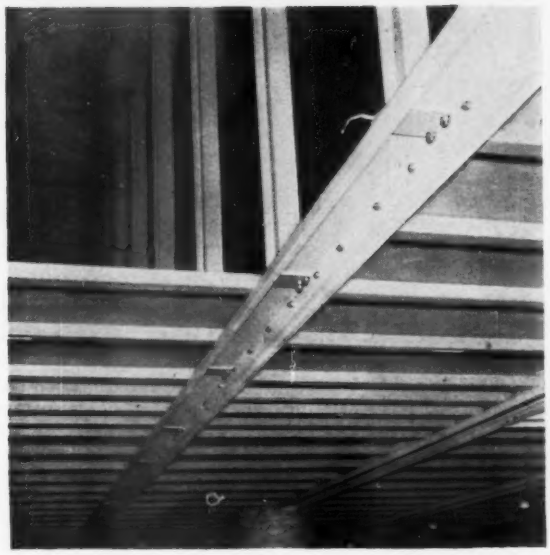
As shown by load figures on the diagram, individual No. 12 branch circuits have plenty of spare capacity to handle the continuous load and voltage drop as well as any foreseeable additional load.

In general, two circuits were brought down into each mezzanine stack in this manner, one passing through and feeding the lower stack through the connecting conduit. Three-way switches fixed to the posts permit operation of the lights from either end.

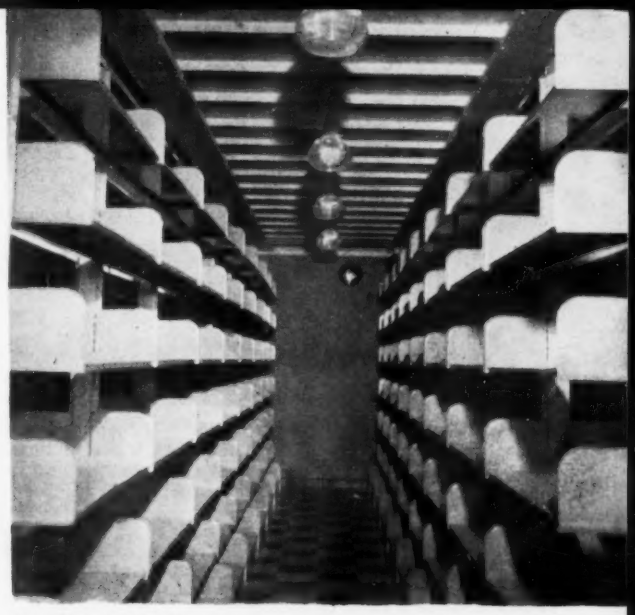
The major portion of the wiring was installed after construction of the stacks was completed. The bottom plate of the longitudinal deck



THREE-WAY SWITCHES at both ends of stacks control the lights in the two adjacent aisles. Switches were installed without boxes, being fastened directly to the posts with self-tapping screws and covered with conventional switchplates.



DECK PLANKS and longitudinal beams partially installed. Beams are first bolted to underside of vertical posts; metal planks are then laid across beams and bolted in place, their interlocking edges forming the transverse raceways between beams. Floor tile was later laid over the metal deck plates.



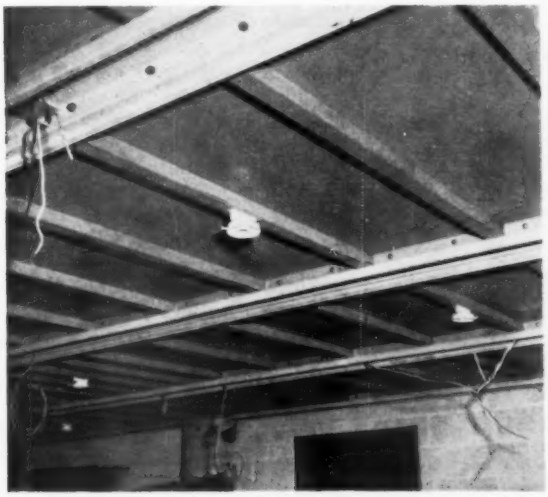
COMPLETED STACK with shelving in place between posts. These are free-standing stacks on the concrete slab, the lighting fixtures being installed with Condulets to transverse raceways of mezzanine deck. Longitudinal raceways with cover plates installed are visible over the stacks.

beam is removable, so that the conductors could be pulled down into the posts, run along inside the open-bottom deck beams, and spliced and pulled into the transverse raceways to feed the fixtures. The bottom plate sections were then screwed in place with sheet metal screws.

Access to the transverse raceway from the longitudinal deck beams was by means of 1¼-in.-diameter holes drilled in the side plates of the beams. These holes were radiused, or rounded, producing a smooth edge to avoid damage to conductors and making it unnecessary to bush the holes.

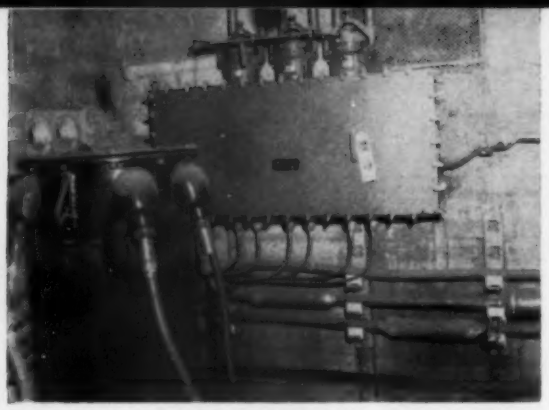
This network of raceway also provides convenient passage for wiring other than stack lighting circuits. Home runs for the first-floor remote control main aisle lighting circuits, for example, are carried down from the second floor slab through concrete inserts into posts of the mezzanine stacks and along the longitudinal and transverse raceways to the fixtures.

Brown Electric Co., New York contractors on the job, had no difficulties with the system, finding it extremely flexible and capable of extensive electrical modification or expansion at any time without structural change to the building.

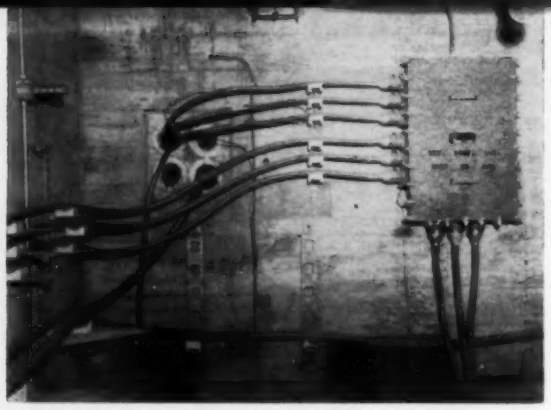


MEZZANINE FLOOR structure completed, before installation of lower free-standing stacks. Condulet-mounted fixture sockets are in place, and conductors have been pulled from fixtures through transverse raceway into longitudinal raceway.

DECK BEAMS are accessible from below through the removal of the bottom plate. After conductors were installed and splices made, the bottom plates were replaced with sheet metal screws.



PRIMARY DISTRIBUTION CABINET in existing transformer vault No. 1. Transformer on left of picture is one of three 50-kva, 3-phase, 2400-volt units that will be changed to three, 100-kva, 3-phase, 4160-volt transformers.



SECONDARY DISTRIBUTION CABINET in existing transformer vault No. 1. The panel is of special construction for subway installations. The first transition to ac current began in 1940.

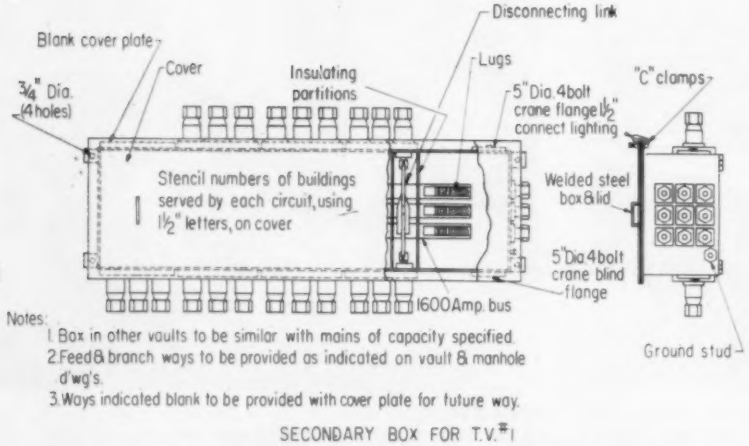
Remodeling

Underground Distribution System

for a State Hospital

. . . . . as part of a conversion program from dc to ac power for 51 assorted buildings. The job calls for 6,100 ft of new trenching and installation of 15,000 ft of fiber duct.

By Conrad W. Baer, *President, Baer Electric Co., Moline, Ill.*

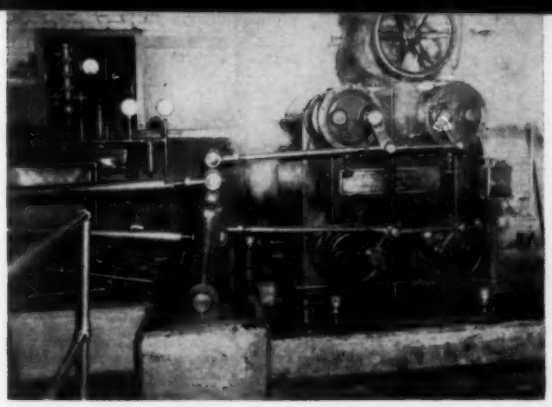

Disconnecting link
Blank cover plate
Cover
Lugs
Insulating partitions
"C" clamps
¾" Dia. (4 holes)
5" Dia. 4 bolt crane flange ½" connect lighting
Stencil numbers of buildings served by each circuit, using 1½" letters, on cover
Welded steel box & lid
5" Dia. 4 bolt crane blind flange
1600 Amp. bus
Ground stud
Notes:
1. Box in other vaults to be similar with mains of capacity specified.
2. Feed & branch ways to be provided as indicated on vault & manhole d'wg's.
3. Ways indicated blank to be provided with cover plate for future way.
SECONDARY BOX FOR T.V.# 1

SECONDARY BOX in existing transformer vault No. 1. Detailed drawing shows secondary distribution from vault.

THE State Hospital in East Moline, Ill., is in the process of replacing its outdated dc system with a new ac program. The conversion job from dc to ac power begins at a new power house that is currently under construction. The new plant will increase the generating facilities of the institution from approximately 600 kw to 2000 kw, with future space designed for another 1000-kw generator.

The change-over job is divided into separate contracts. One is the new underground distribution system. Another is a conversion contract that includes connecting and changing the panelboards of each individual building. The third in-

ONE OF TWO 2400-volt, 3-phase, 125-kva, ac generators now in use. This unit will be replaced by two new 1000-kw generators in new plant.



ENGINE OPERATING a dc generator. This engine drives one of the original dc units installed at the institution which develops 75 kw.

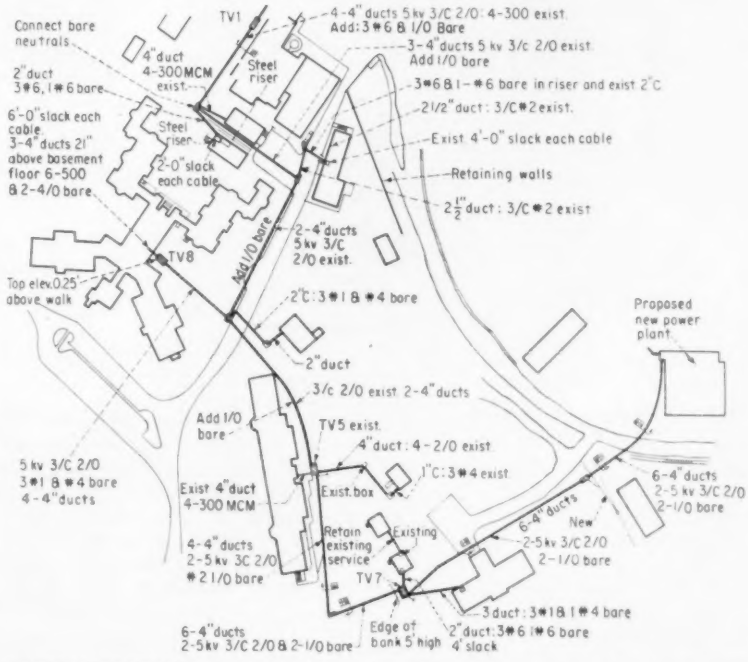
cludes the electrical installation in the new power plant. Baer Electric Company was awarded the contract for the underground distribution. The conversion contract will be awarded at a later date. John D. Jarvis is the supervising architect and Consoer, Townsend and Associates, of Chicago, are the consulting engineers, electrical design by Z. R. Miliski.

Although the complete modernization program is presently in its final stages, the original change to ac power began in early 1940. At the present time half of the buildings are being served by two 2400-volt, 3-phase, 125-kva, ac generators. The rest of the institution is served by three 115-volt, dc generators, with a total capacity of 350 kw. When the new power plant is finished, primary steam will drive the generators, and secondary steam will supply laundry, cooking and heating facilities. On completion of the entire job, the existing 2400-volt, 3-phase distribution will be converted to 4160 volts, 3-phase 4-wire. And secondary distribution will be at 120/208 volts, 3-phase, 4-wire. Under the existing generating and distribution system, load growth for the past number of years had to be curtailed because of the limited generating and distribution capacity of the system. After the conversion program is completed, the institution will be able to add necessary load as required to meet all of their electrical demands. At the present time energy consumption totals approximately 190,000 kwh per month.

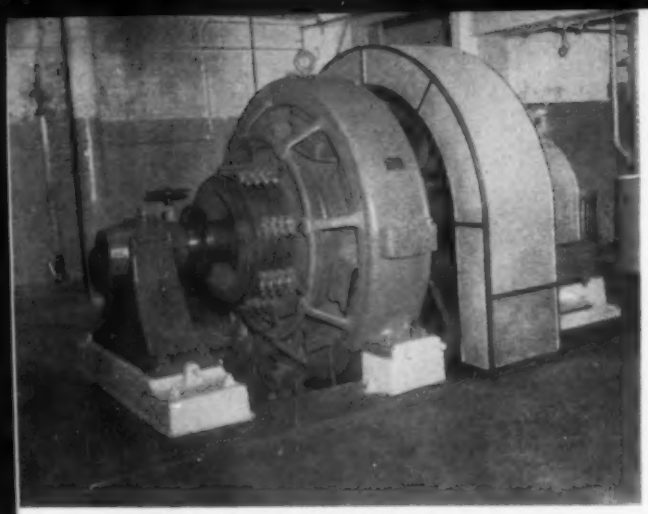
Expansion of the underground network begins at the new power house; 6,100 ft of new trenching with 15,000 ft of concrete-encased fiber duct will be required. Baer Electric's contract also includes construction of seven new manholes and three new underground transformer vaults. These tie in with nine manholes and six transformer vaults of the existing system.

Two runs of six 4-in. fiber ducts split the institution's primary distribution system in half. Each originates at the new power house and is arranged to connect the new vaults and manholes with those existing. Wherever possible existing ducts will be retained and a bare copper conductor will be added to provide the neutral for the 4-wire system.

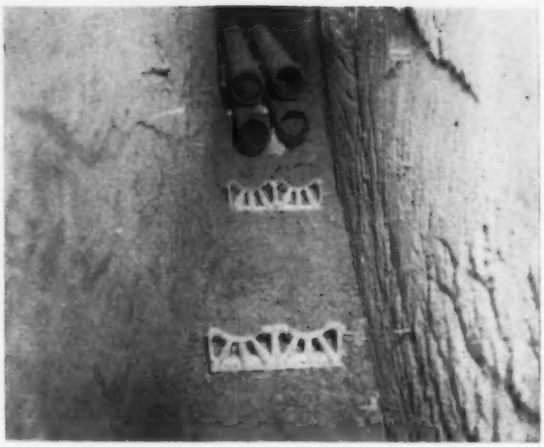
For example, here is a partial description of the underground system, as shown in the southeast plot plan below. A run of six 4-in. ducts connect the new power house to new manhole No. 10 and new underground transformer vault No. 7. Two of the new ducts each con-


TV1
4-4" ducts 5 kv 3/C 2/0: 4-300 exist.
Add: 3#6 & 1/0 Bare
Connect bare neutrals
4" duct 4-300MCM exist.
Steel riser
3-4" ducts 5 kv 3/c 2/0 exist.
Add 1/0 bare
2" duct 3#6, 1#6 bare
3#6 & 1-#6 bare in riser and exist 2"C
2½" duct: 3/C#2 exist.
6'-0" slack each cable
3-4" ducts 21" above basement floor 6-500 & 2-4/0 bare
Steel riser
Exist 4'-0" slack each cable
2-0" slack each cable
Retaining walls
2½" duct: 3/C#2 exist
2-4" ducts 5 kv 3/C 2/0 exist.
TV8
Add 1/0 bare
Top elev. 0.25" above walk
2"C: 3#1 & #4 bare
Proposed new power plant
2" duct
3/c 2/0 exist. 2-4" ducts
Add 1/0 bare
TV5 exist.
4" duct: 4-2/0 exist
1"C: 3#4 exist
5 kv 3/C 2/0 3#1 & #4 bare 4-4" ducts
Exist 4" duct 4-300 MCM
Exist. box
6-4" ducts 2-5 kv 3/C 2/0 2-1/0 bare
Retain existing service
Existing
6-4" ducts New
4-4" ducts 2-5 kv 3C 2/0 #2 1/0 bare
TV7
2-5 kv 3/C 2/0 2-1/0 bare
3 duct: 3#1 & 1#4 bare
6-4" ducts 2-5 kv 3/C 2/0 & 2-1/0 bare
Edge of bank 5' high
2" duct: 3#6 1#6 bare 4' slack

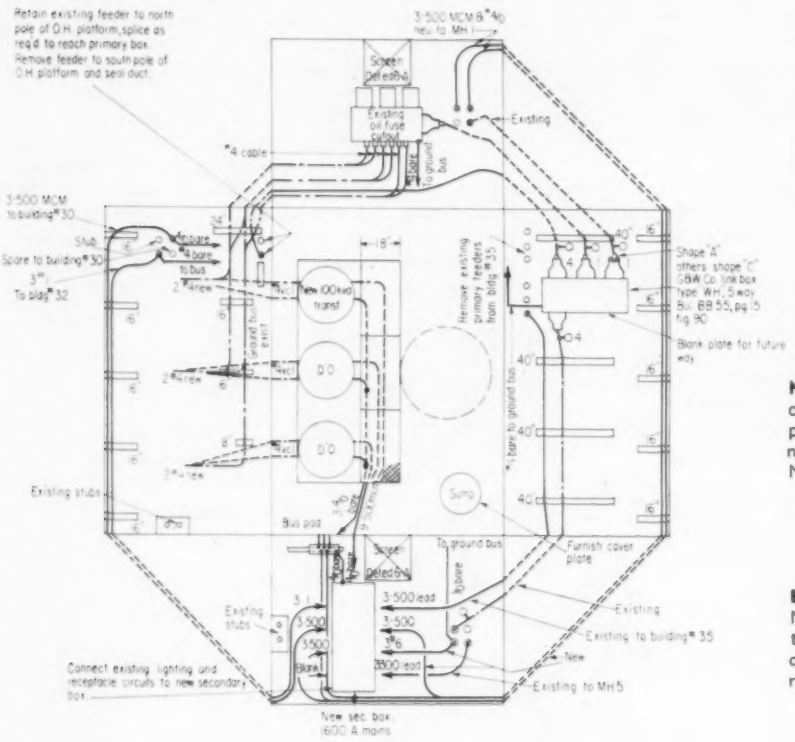
PARTIAL DIAGRAM of southeast plot plan shows one run of six 4-in. fiber ducts leaving the new power house to connect new transformer vaults and manholes with those existing.

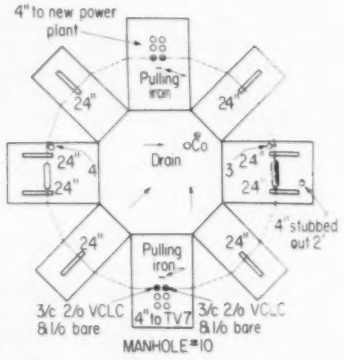


EXISTING 150 KW GENERATOR. One of three 115-volt, dc generators now in use. After new power plant is finished, all three dc units will be discontinued.



IN TRENCH 4-in. fiber duct runs to existing manhole No. 1. When run is completed it will be encased in a poured concrete envelope.


Retain existing feeder to north pole of O.H. platform, splice as req'd to reach primary box. Remove feeder to south pole of O.H. platform and seal duct.
3-500 MCM B"40 new to MH
Existing
4 cable
3-500 MCM to building #30
Spare to building #30
To bldg #32
Remove existing primary feeders from bldg #35
Shape "A" others shape "C" G&W Co. link box type WH, 5 way Bul. BB 55, pg 15 fig. 90
Blank plate for future way
100 kva transf
Existing stubs
Bus pad
To ground bus
Furnish cover plate
3-500 lead
Existing to building #35
New
Existing to MH 5
Connect existing lighting and receptacle circuits to new secondary box
New sec. box 1600 A mains



NEW MANHOLE No. 10 shows location of ducts entering manhole from new power plant and location of ducts leaving manhole to proceed to transformer vault No. 7.

BLOW-UP OF TRANSFORMER VAULT No. 1 shows details of duct connections to vault and locations of primary switches and secondary panels, plus location of new 100-kva transformers.

tain one 5-kv, 3-conductor, 2/0 cable and one No. 1/0 bare copper conductor. The four other ducts are spares. A similar duct run goes from transformer vault No. 7 to new manholes No. 11. Here a run of four 4-in. ducts (two spares) goes to existing transformer vault No. 5. Cable sizes are the same. An existing run of two 4-in. ducts from vault No. 5 to existing manhole No. 7 is reused by simply adding a No. 1/0 bare copper conductor in each duct to provide the new 4-wire system. The remainder of the underground primary system is similarly interlaced. Secondary distribution is also underground. This is provided for by the use of subway type, secondary distribution panels located in each transformer vault. Secondary wiring to the buildings is in fiber duct with cable sizes ranging from 500,000 to No. 4 underground wire. The size of the conductors is determined by the load of the building they are feeding.

Over 6,000 ft of 3-conductor, 5-kv, LC, VC cables will be installed to carry the system's primary voltage, plus over a total of 18,000 ft of the various size secondary cables. Grounding conductors for the transformer vaults and manholes will be 4/0 bare copper wire.

After all the duct runs are installed and the concrete is set, each fiber duct run will be measured ex-

RUN OF SIX 4-in. fiber ducts is shown adjacent to newly constructed transformer vault. Connecting stubs are shown sticking out of the vault wall.

PARTIALLY CONSTRUCTED TRANSFORMER VAULT, one of three additional vaults called for in the new underground distribution system.

POURED CONCRETE ENVELOPE encases the entire 15,000 ft of 4-in. fiber duct.

RUN OF FOUR 4-in. fiber ducts with plastic spacers is located in 8-ft deep trench. The underground distribution job required over 6,100 ft of trenching.

actly. These measurements designing the length of each duct run will be sent to the cable manufacturing company supplying the wire for the job. At the cable factory, all wire will be pre-cut to the lengths indicated by Baer Electric. Also, the factory will equip the lead covered cables needed for the job with pulling lugs. Therefore, when the cables are delivered to the job site, they will be pre-cut to exact lengths, marked for the duct in which they are to be installed and color-coded as per-phase.

As has been pointed out, the job is designed to make use of as much of the existing equipment as possible, and existing transformers were no exceptions. For example, in existing transformer vault No. 3 there are three 25-kva transformers. These will be replaced by three 50-kva transformers taken from the laundry. The laundry will then be supplied with three new 75-kva transformers. The three 25-kva units originally in transformer vault No. 3 will be used in the following manner: one will be installed in transformer vault No. 6, one will be used at the well platform, and one will be placed in stock as spare. With the new system's primary voltage at 4160 volts wye grounded, the existing transformers are to be connected wye-wye, instead of incurring the additional expense of having them rewound. The new transformer banks will then be connected delta-wye.

As the underground distribution job nears its finish, and the new power plant is completed, the existing power house will be kept in operation simultaneously with the new plant until fully connected and energized with ac.

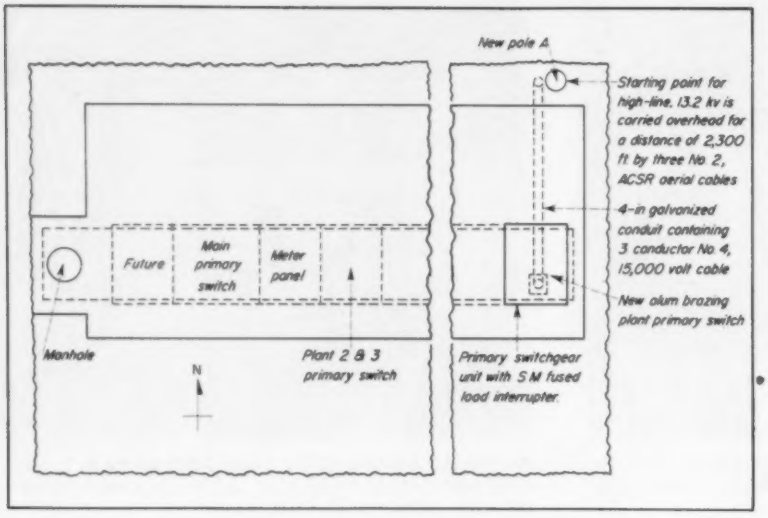

New pole A
Starting point for high-line, 13.2 kv is carried overhead for a distance of 2,300 ft by three No. 2, ACSR aerial cables
4-in galvanized conduit containing 3 conductor No. 4, 15,000 volt cable
New alum brazing plant primary switch
Future
Main primary switch
Meter panel
Manhole
Plant 2 & 3 primary switch
N
Primary switchgear unit with S.M fused load interrupter

FIG. 1 Existing primary switchgear plan shows location of new aluminum brazing plant's primary switch.

Contractor installs . . .

PRIMARY WIRING AND BUS DUCT DISTRIBUTION SYSTEM

for new aluminum brazing plant of Trane Co., La Crosse, Wis. Wiring project includes 2,300 ft of high-line plus 900 ft of in-plant 400-amp 3-phase bus duct distribution.

PROVIDING power for a modern 80,000 sq ft aluminum brazing plant in La Crosse, Wis., called for a dual wiring program. First a 2,300-ft high-line had to be constructed to provide primary service to the building, while in-plant distribution plans called for installing 900 ft of 400-amp bus duct. The plant, which is the newest of Trane Company's many buildings, is 500 ft long and 160 ft wide. It is a one-story structure with concrete block and glass windowed walls built around its steel framework.

The main substation, containing primary switching for all of the company's buildings, is located northwest of the new plant. This was the starting point for the new distribution system installed by Neumann Electric Co., of La Crosse. From a new primary switch added to the main outdoor substation a 4-in. galvanized conduit was run underground to the top of the first high-line pole set on the edge of the substation's concrete apron. A 3-conductor No. 4, 15,000-volt cable in this conduit connects to the aerial conductors on the pole's crossarms. From this point, three No. 2, ACSR aerial conductors carry 13.2-kv distribution 2,300 ft to the new building.

The high-line, consisting of 19 spans of approximately 120 ft each, terminates at a dead-end pole 8 ft from the end of the concrete shipping dock runing along side of the new building. Primary power is brought down the pole in three No. 2, 15,000-volt rubber insulated, shielded conductors encased in 4-in. conduit. Because the power supply from the utility is ungrounded, all cables are insulated for full phase voltage to ground.

Underground primary service continues in a twin-duct raceway from the high-line pole to the plant's distribution substation. One run of 4-in. fiber duct contains the service cables; the second is used as a spare. Both runs are encased in a concrete envelope 16-in. by 12-in. poured before the concrete shipping dock was constructed. About 220 ft from the pole, a 48-in. by 60-in. concrete-block manhole permits a right-angle turn in the duct line and facilitated cable pulling.

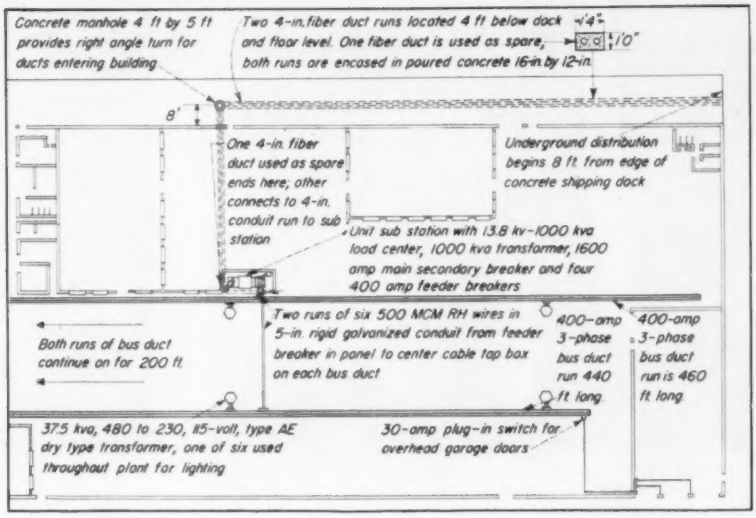
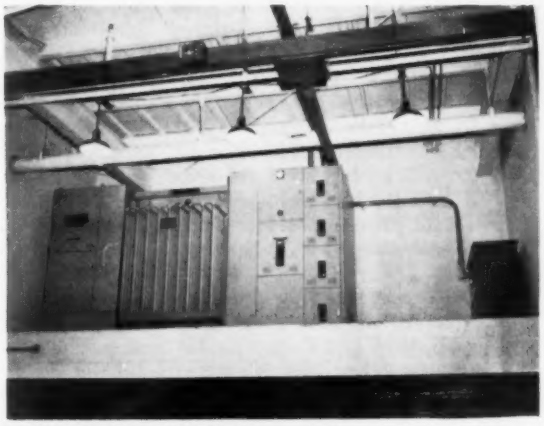

Concrete manhole 4 ft by 5 ft provides right angle turn for ducts entering building
Two 4-in. fiber duct runs located 4 ft below dock and floor level. One fiber duct is used as spare, both runs are encased in poured concrete 16-in. by 12-in.
1/4"
1'0"
8'
One 4-in. fiber duct used as spare ends here; other connects to 4-in. conduit run to sub station
Underground distribution begins 8 ft. from edge of concrete shipping dock
Unit sub station with 13.8 kv-1000 kva load center, 1000 kva transformer, 1600 amp main secondary breaker and four 400 amp feeder breakers
Two runs of six 500 MCM RH wires in 5-in. rigid galvanized conduit from feeder breaker in panel to center cable tap box on each bus duct
400-amp 3-phase bus duct run 440 ft. long
400-amp 3-phase bus duct run is 460 ft. long
Both runs of bus duct continue on for 200 ft.
37.5 kva, 480 to 230, 115-volt, type AE dry type transformer, one of six used throughout plant for lighting
30-amp plug-in switch for overhead garage doors

FIG. 2 Partial plan of building shows layout of bus duct system throughout plant, the fiber duct raceway entering building underground, and substation location and transformer mountings.

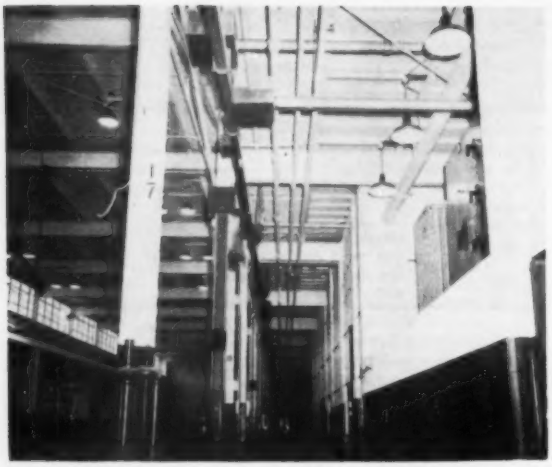
MAIN SUBSTATION housing primary switching for all of Trane Company's buildings in the La Crosse plant is starting point for high-line distribution system.

HIGH-LINE constructed by Neumann Electric Co., of La Crosse, delivers 13,800-volt primary to new plant located 2,300 ft from main outdoor substation.

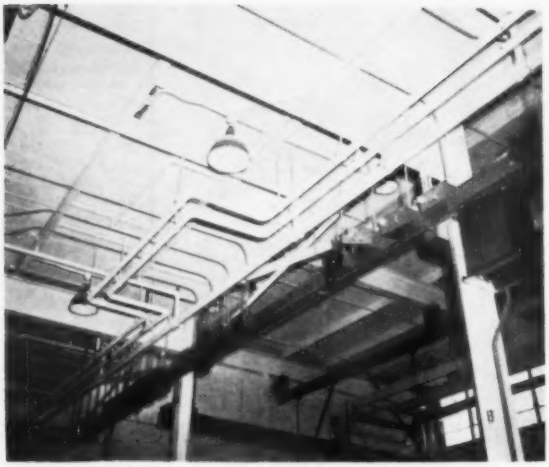
PRIMARY leaves high-line dead-end pole to travel underground for a distance of 300 ft to plant's unit distribution substation.



DISTRIBUTION SUBSTATION located in center of plant is 13.8 kv-1000-kva load center complete with primary entrance, 1000-kva transformer, and secondary and feeder breakers.

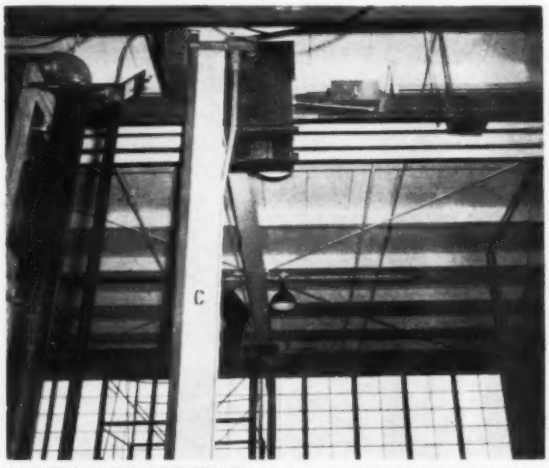


CENTER FEEDS supply power to 900 ft of 400-amp 3-phase bus duct. The 5-in. conduits containing six 500,000 MCM RH cables are run overhead.



BUS DUCT RUN shown here features individual fused plug-in switches for fabricating machinery located in this section of the plant.

400-AMP 3-PHASE BUS DUCT distributes power throughout plant by means of two separate runs of 460 ft and 440 ft each. All sections of bus duct are rod-suspended on ceiling.



LIGHTING TRANSFORMER, column-mounted by angle iron supports, is one of six 37½-kva transformers used for building lighting.

The unit substation is located on a mezzanine midpoint along the length of the building. It contains a primary breaker, a 1000-kva transformer, a 1600-amp main secondary breaker and four 400-amp feeder breakers. From two of the 400-amp feeder breakers, runs of 5-in. conduit containing six 500,000 MCM RH cables were installed overhead to provide a center point feed to the bus duct distribution system.

Flexible secondary distribution is provided by two runs of 400-amp 3-phase plug-in bus duct, one 460 ft long, the other 440 ft. From these bus duct lines subfeeders and motor branch circuits are run to individual loads throughout the plant through fusible type plug-in bus switches. Branch circuiting and subfeeders are carried in rigid steel conduit. After building occupancy some drops to motorized machinery will be supplied by portable type S O cord. All sections of bus duct throughout the plant are supported by means of ¾-in. threaded steel rods.

An elevator type scaffold designed by F. H. Neumann of Neumann Electric Co. helped to simplify this operation. The device employs a 4-ft by 5-ft by 1-ft angle iron frame that enables a conventional steel piping scaffold to ride up and down inside it by use of steel cables and a manually operated crank. This telescoping feature extended the mobility of the unit. In addition to positioning mechanics and material for easy installation, it facilitated scaffold travel under low beams.

Six 37½-kva transformers are used for building lighting. They are installed throughout the plant on angle iron frames welded to steel columns adjacent to bus duct runs.

The plant, which will be used for the manufacturing of heat exchangers for aircraft and atomic energy production, includes other modern electrical features. Among these are: mercury-vapor general lighting; automatic time clock and program clock systems; fire alarm control; electrically operated overhead garage doors; 14 electrically driven monorails; and four large bridge cranes.

Modernization of New England Church includes . . .

OBJECTIVE LIGHTING PLAN

. . . in addition to low-voltage remote control, new primary switchgear, hi-fi sound system, structural improvements and architectural refinements.

THE old proverb that "it's an ill wind that blows nobody good" recently was recalled to mind when we heard of an impressive church modernization program which had been initiated by a normally disastrous attack of termites. For, when swarms of these hungry insects infested the wooden substructure of the Church of the Most Precious Blood in Hyde Park, Mass., the congregation of that edifice had the rather drastic alternative of either abandoning the decaying structure to ultimate ruin, or of subscribing to an extensive modernization campaign which would literally have to start "from the ground up". The fact that they adopted the latter plan is testimony to a desire to preserve the traditional beauty and significance of the original structure, while the overall design (including ornamental lanterns, new altars, sanctuary alterations and church furniture) reflects the motivating vision and spirit of the pastor, the Rt. Rev. E. A. Moran.

It was he who called upon the Morey T. Pike Electrical Company to handle the complete electrical modernization plan. And, in turn, Morey obtained considerable assistance from Boston Edison lighting engineer Ted Williams and from Ed Boegel of the Rambusch Decorating Co.

The result of their collective thinking is an appealing lighting installation that contributes greatly to the beauty of this place of worship; a practical low-voltage control system that permits convenient selection of numerous luminous environments; a high-fidelity microphone-amplifier-speaker installation that distinctly carries voice and music at low audio levels to all parts of the nave and transepts; a protective-wire fire detection system which insures this new investment against damage from flames, and a new electrical service entrance and primary switchboard with sufficient spare capacity for all contemplated present and future needs. Combined, this electrical modernization program has had a definite influence on the increased service and usefulness of the church, while the quality and quantity of the lighting installation is such that it has been honored through the awarding of a Certified Lighting certificate, approved by BE's certifying agent Ray L. Smart.

Variety of Lighting Mediums

Lighting mediums used to illuminate the interior of the church are varied in both design and installation detail, for two types of custom-made ornamental lanterns are suspended in view of the worshipers; three sizes of baffled downlights are ceiling-recessed to raise footcandle levels when and where required; vertical fluorescent striplights are placed behind sanctuary columns to sidelight the altar; while shielded floodlights and spotlights are variously placed to highlight specific areas which otherwise

RELIGHTING PROGRAM included installation of new Rambusch chain-suspended ornamental lanterns and ceiling-recessed downlights, fluorescent striplights shielded from view by contour of sanctuary columns, plus numerous small flood- and spot-lights to lessen general brightness ratios or to highlight specific focal centers. Control of lighting installation may be obtained remotely from low-voltage panel in sacristy, or locally by conventional switches.

COMPARISON with former lighting installation is remarkable, for fewer visible fixtures are in evidence in new arrangement, contrasts have been greatly modified, glare is minimized, shadows are absent, while many architectural features and ecclesiastical symbols which formerly went unnoticed are now clearly revealed for the appreciation and inspiration of worshipers. Lighting modernization included installation of 43 assorted fixtures with combined load of 15½-kw.

would mar brightness patterns.

Two of the ornamental lanterns are large corona assemblies, measuring 4 ft in diameter and 8 ft in height, chain-suspended in the transept 16 ft above the floor. Each of these units consists of a center lantern containing a 300-watt lamp, plus six smaller tubular luminaires enclosing 100-watt lamps. Minimum surface brightness and pleasing diffusion is obtained through the use of pale amber glassware, while open fixture bottoms permit higher downward components of light to illuminate the front of the church.

The second type of ornamental lantern is a single globe, single lamp, 300-watt unit, likewise chain suspended; three such units illuminate each of the two side aisles, with a seventh lantern adding focal interest above the choir loft at the rear of the church.

These lanterns admirably serve their intended purposes of furthering the Gothic design of the edifice and of providing low-intensity diffused tonal warmth for the interior of the structure. They do not, however, provide sufficient illumination for easy reading of prayer books or hymnals by the congregation, so additional downlights were recessed into the ceiling for that purpose. Seven large 750-watt units were spaced along the apex of the vaulted center ceiling, four 300-watt units being located above the choir loft, while two additional 200-watt units are recessed in the transepts. Downlights are annularly baffled to eliminate spill-light and glare; are equipped with finned radiator lamp housings to dissipate internal heat and prolong lamp life; and are fitted with polished Alzak aluminum reflectors to promote efficiency and insure uniform beam patterns. All units except the one nearest the altar are mounted vertically, that remaining luminaire being tilted so that the front wall obtains a greater proportion of vertical illumination.

To further highlight the sanctuary, two 2-lamp 75-watt fluorescent lamp strips are located vertically, one above the other, on either front side wall, being shielded from view of the congregation by the contours of adjacent wall columns. Frosted glass panels provide proper diffusion, while a combination of standard-cool and deluxe-warm white lamps were used to bring out the full richness of the blues, golds and natural wood grainings concentrated in this important focal center.

Additional illumination for upper ceiling areas is provided by 150-watt R40 floods, properly shielded and mounted atop each of the side fluorescent strips, while illumination at either side of the altar is raised through the utilization of four 150-watt adjustable spotlights which may be rotated through full azimuth and 45-degree declination.

Completing the lighting modernization program, four 300-watt glass-enclosed luminaires were installed in the sacristy to provide illumination for the vesting of priests prior to services.

The result of this installation is an average level of illumination of 10 footcandles in the nave and transept, while peaks of 20 fc are to be measured directly beneath downlights in the sanctuary. It is also pertinent to mention that the installation enhances the traditional beauty of the structure, reveals numerous architectural features which formerly were hidden in shadows, yet provides sufficient light for all reading and other activities preferring higher seeability.

Low Voltage Remote Control

These various new lighting fixtures, 43 in number and having a connected electrical load of 15,000 watts, are controlled remotely from

a central circuit-breaker panel located in the sacristy. Control wiring is low voltage, with related relays gang-mounted above the sacristy ceiling. From this central control point, lighting in all sections of the church may be regulated, although an additional series of switches located throughout the church provides for local control of individual units when so desired.

To adequately provide for this installation, a complete new primary service entrance was installed, including a 400-amp main switch, a 200-amp and a 100-amp sub-main, 500MCM RH feeders in conduit, dead-front switchgear enclosures and a comprehensive grounding system.

One of several interesting installation techniques pertained to the placement of recessed downlights along the high apex of the Gothic ceiling. These units were mounted by first cutting holes through from the overhead attic space, lowering ropes through the holes in order to raise bottom face plates into position, then securing these plates to the bodies of the fixtures. The job was understandably an exacting one, for working quarters were confined, the possibility of cracking adjacent plastered areas had to be considered, securing bottom plates from above was ticklish work, while falling debris had to be prevented. This was accomplished by initially cutting holes only large enough to permit the passage of a closed umbrella, which was then opened up beneath the aperture in order to catch all falling materials. When the holes were enlarged to their full diameter and the edges finally smoothed, the umbrella was then collapsed and, with the debris contained within, it was pulled back up into the attic space.

In conjunction with these electrical improvements and modernized lighting, the interior of the church was completely refurnished with new altars, sanctuary, choir loft, pews, wall coverings and repainting, while the physical condition of the edifice was structurally rehabilitated by replacing wooden partitions with brick, wooden floors with concrete slabs, and wooden bearing timbers with steel beams.

The results are understandably impressive, for the traditional ecclesiastical atmosphere has been enhanced; improved lighting has promoted easier reading of printed material which, in turn, has promoted greater congregational participation in services; while the beautiful interior architectural details are now as plainly visible during evening vespers as at morning Masses.

RECESSED DOWNLIGHTS are finned with radiator construction to dissipate internal heat and thereby prolong lamp life. Reflectors are of polished Alzak aluminum to insure uniform beam patterns, while annular baffles minimize source-brightness and spill-light from these units. Fixtures were installed and are serviced from above. Unit near altar is tilted to direct greater component of vertical illumination upon front wall of the church interior.

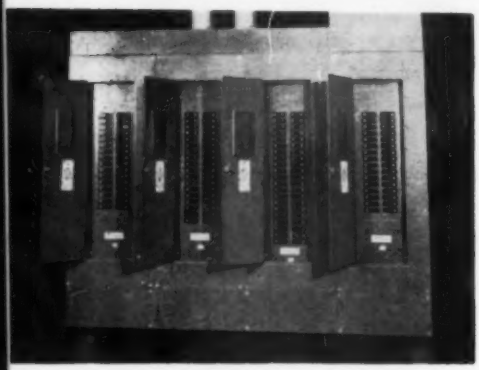
RECESSED DOWNLIGHTS between Gothic ceiling arches greatly increased illumination in pews for reading of printed material, thereby promoting participation of worshipers in the services. General brightening of interior was also furthered by adopting lighter wood tones, floor covering and wall painting values, thereby improving reflectance factors and boosting light levels by interflection.

SAME APERTURE OF LENS and timing interval of camera gives dramatic factual proof that old lighting installation was inadequate, spotty, glaring and conducive to formation of deep shadows. Extensive modernization program also included replacement of wooden partitions, floors and beams with brick, concrete and steel and installation of complete new service entrance and switchgear assembly.

CEILING TROUGH on underside of slab covers opening left by concealed trough serving as terminal for slab conduits. Wireway to panel enclosure below is 4 inches deep and 14 inches wide; has full-length metal partitions to group conductors to four panels in enclosure.

TROUGHS SIMPLIFY BRANCH CIRCUIT WORK

Extensive use of special wiring layouts at distribution centers has simplified branch circuit installations on projects of the Continental Electrical Construction Company, Chicago.



MULTIPLE PANEL ENCLOSURE contains four panels totaling more than 140 branch circuits. Wireway at right carries branch circuit conductors from ceiling and concealed slab troughs above. Overhead feeder conduits go to main panel and transformers opposite. Equipment is spotted beneath removable stairwell slab.

TRIM APPEARANCE is provided by trough and wireway technique where space is limited and beam requires offset of branch circuit raceways. Three panels below contain 72 lighting and 16 receptacle circuits.

EXTENSIVE use of concealed metal troughs and exposed metal wireways at distribution centers has simplified branch circuit installations on projects of the Continental Electrical Construction Company, Chicago. Biggest advantage, to date, is the complete elimination of "stubbing down" home run conduits in slab construction with the inherent "nippling out" to panel enclosures. The trough approach also avoids crossover of home run conduits in the slab above distribution centers to meet necessary alignment for specific panels.

Originally used in a large midwestern shopping center development, the trough and wireway technique has become standard design and installation procedure for Continental on department store and shopping center projects.

According to Will Liebow, Continental project engineer, the newly adapted method involves the following raceway items:

1. An open-bottom, screw-cover top, 12-gauge, galvanized steel trough concealed in the ceiling slab over the distribution panel.

2. An exposed, 12-gauge, galvanized steel, open-top trough which fits over the opening of the concealed slab trough. Size and shape of this trough is dictated by structural conditions at the distribution center (see Fig. 1) and it is normally constructed from field dimensions. These troughs may have one or more screw-cover side panels.

3. A totally-enclosed steel wireway, with removable front panels, to carry the branch circuit conductors down to the multiple-panel enclosure. These panel wireways are divided by full-length metal partitions to sectionalize grouped conductors serving specific panels in the combination enclosure.

The slab trough is the first of the three-part raceway system to be installed. It is positioned above panel locations and nailed to the wood forms when the network of branch circuit conduits and outlet boxes is being installed on the deck. An exterior flange around the open side of the slab trough has a number of mounting holes as well as threaded holes which accommodate supporting screws for the exposed trough which is to be added to the underside of the slab after the forms are removed and the panels are set. All concealed conduits terminate in knockouts in the sides of this slab trough. The screw-cover top is removed to install and tighten conduit locknuts and bushings, then replaced before the slab is poured. Size of this trough depends upon the slab thickness, number of conduit terminations and size (number of circuits) of the panels below. The one illustrated in Fig. 1 is 3 ft long, 18 in. wide and 3½ in. deep.

After the deck forms have been removed, and the distribution panels are set, the exposed metal trough with an exterior mounting flange is mounted to the under side

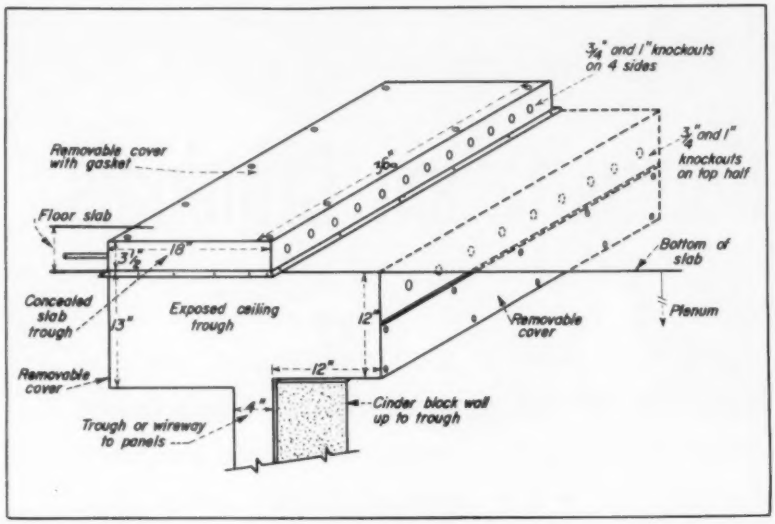


FIG. 1.—Terminal troughs for concealed slab conduits and wireway connections to multiple-panel enclosure below. Top, open-bottom trough is mounted on deck forms; lower, open-top trough is added after forms are removed.

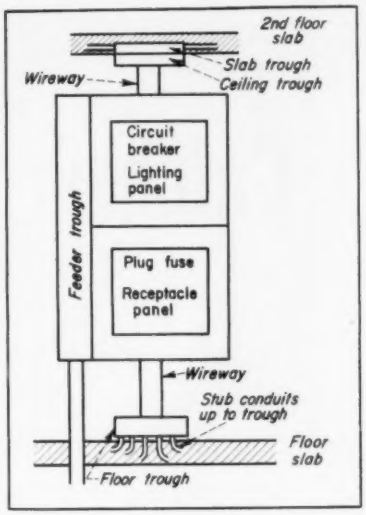


FIG. 2—Dual panel distribution center using ceiling and floor troughs for branch circuit conduits.

of the slab to cover the opening of the slab trough. Either the screws previously mentioned or metal cleats bolted to the slab can be used to support the exposed section of trough. This combination of troughs, in effect, provides a complete metal conductor enclosure with one section concealed in the slab and the other section projecting below. Fig. 1 shows one dual trough concept designed for a specific panel installation.

Bonding lugs attached to the inside of each trough accommodate a bare stranded copper wire jumper to maintain ground continuity throughout the metallic raceway system.

Connection between the ceiling trough and the multiple-panel enclosure is made by a wide steel raceway with enough metal partitions to group the branch circuit conductors for each panel in the enclosure. Divided screw-cover sections form the face of this wireway, providing easy access to the wireway for conductor installation and maintenance. Normally, this raceway is 4 in. deep. Width depends upon the number of panels and circuits involved. Length and number of offsets in this connecting wireway is a function of panel location and number and type of structural obstacles encountered.

In all cases, the connecting wireways are designed to conform to Section 3624, NEC, including cross-sectional fill and total number of conductors in the sections formed by the three wireway partitions.

Prime reason for going to this trough-wireway method in the shopping center project was the fact that more than a dozen electrical distribution centers throughout the 2-story and basement structure were spotted under stairs and in more or less confined "electrical center" rooms. Space was at a premium and Continental's engineers selected this technique as offering the best working conditions and most pleasing final appearance. It proved particularly advantageous in the open basement area where transformers and panels are spotted directly beneath stairwells with removable slabs. Should the owner decide to extend the stairs at a later date, he can have the slab removed, stairs installed, and walls built to enclose the area without disturbing the electrical system.

Another variation of the trough and wireway technique was used by Continental Electric Construction Co. in a commercial building installation. Here, (Fig. 2) both ceiling and floor troughs formed part of the branch circuit distribution system.

The dual panel enclosures contain a lighting circuit breaker panel in the top section and a plug-fuse distribution panel in the lower section to serve receptacle circuits. Conduits in the ceiling slab terminate in a slab trough as outlined before. To prevent possible damage due to moisture or water, conduits in the floor slab turn up into an exposed trough beneath the panel enclosure. Metal wireways connect both ceiling and floor troughs with the panel enclosure. A third trough (or auxiliary wireway) running the full height of the panel enclosure houses the panel feeder cables and keeps them out of the gutter space normally allotted to branch circuit conductors. The overall design simplifies installation and maintenance at the distribution center.

PULL BOX in narrow electrical distribution "closet" carries feeders to 3-panel center at left and panels on floor above. Because of confined space, several feeder conduits pass through the 36 in. by 24 in. by 21 in. box.

Catching Commutation Criminals

Chipped brushes, frayed shunts, evidence of sparking or copper particles imbedded in brush surfaces are tell-tale clues identifying various causes contributing to short brush life or poor commutation on dc machines. Recognizing these and other clues will promote efficient maintenance, since corrective measures can then be taken before minor faults become serious.

By J. V. Dobson and D. R. Dobson, *Chief Engineer and Special Representative*
Stackpole Carbon Co., St. Mary's, Pa.

MODERN criminologists frequently identify known criminals by the manner in which certain crimes are committed. These techniques which are peculiar to individual criminals are referred to as the "modus operandi" and detectives habitually search for such clues or crime patterns which will thereby narrow a field of suspects. By reducing numerical odds in this manner, criminologists have a realistic chance to catch a culprit before he commits other, more serious crimes.

Similarly, when investigating poor commutation or short brush life on a dc machine, an alert maintenance man frequently can detect a "modus operandi" that will reveal the identity of a known "commutator criminal".

In this search for clues, a good starting point is to critically examine the brushes, keeping in mind the fact that all commutation loves symmetry and that dissimilarities can often point an accusing finger at the cause of offending current collection.

Clue No. 1—Chipped Brushes

The easiest clue to detect is chipped or broken brushes. This is usually representative of severe brush movement or chattering due to high or low bars, flat spots on the commutator, high mica, excessive mechanical vibration, extended period of light- or no-load running, improper spring pressure or an undesirable commutator film condition.

Clue No. 2—Side Wear

Brush chipping and breakage is usually accompanied by indications of wear on the sides of the brushes. These wear marks are highly glazed areas caused by the polishing action between the brushes and the brush box. Side wear sometimes occurs without being accompanied by brush chipping or breakage. This is representative to a lesser degree of the same undesirable conditions that cause chipping and breakage. Side wear can also be caused by eccentric commutators—a condition which rarely causes brush breakage.

Clue No. 3—Finger Prints

Indentations in the carbon or metal "A" plate on the top of a brush represent extreme brush movement, brush chatter or passage of electrical current from the brush through the pressure finger to the brush box and the bus. When current passes through the pressure finger it usually anneals the pressure spring and results in loss of pressure on the box. The passage of current through the pressure finger occurs when the normal brush shunt is either extremely overloaded or is not functioning properly due to a faulty connection between the brush and the shunt or the shunt terminal and the terminal block. Failure of the shunt to brush connection is a result of excessive vibration of the brush which could be substantiated by examining for some of the clues outlined above. It is easy to see here the complex interdependence which might be built up to cause undesirable commutation.

Clue No. 4—Evidence of Current Passage

The evidence of current passage from the sides of a brush to the brush box presents itself in the form of craters in the brush material and in extreme cases it actually erodes part of the brush away causing the side of the brush to become concaved. This passage of current is caused by failure of the brush shunts or shunt terminal connections or extremely overloaded

brushes. Usually when current passes from the brush to the brush box there is also distress to the surface inside the brush box due to a similar type erosion.

Clue No. 5—Frayed Shunts

Frayed shunts occur when the small .005-in. thick wires which are stranded to form the shunt cable become broken. Shunt fraying is caused by excessive vibration of the brush in the holder, vibration of the shunt due to its location with respect to high velocity cooling air, atmospheric attack of the shunt wire causing corrosion or imbrittlement of the individual wires caused by overheating and oxidation of the shunt material, burning of the individual wires due to machine flashovers, or shunts too long which can be shorted against the frame. Tinned shunt wires are frequently used to reduce the corrosive action of bad atmospheres. Glass sleeving is frequently used to prevent shunts from shorting against the frame and vibrating excessively in air streams. Glass sleeving also reduces corrosion from atmospheric conditions.

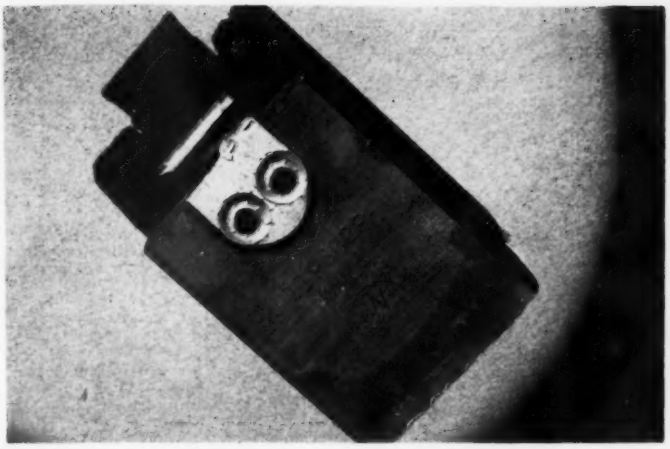
Shunts normally used on industrial size carbon brushes are made of wires .005 in. in diameter which are wound into strands. Seven strands are wound to make the final shunt cable. The size of the shunt is governed by the number of .005 wires in each strand. The size of shunt used on a Westinghouse brush is determined by the cross sectional area of the brush, the current carrying capacity of the material out of which the brush is made and a shunting table conservatively set up to insure a capacity well above NEMA Standards. NEMA Standards are set up to give a temperature rise below 60 degrees C in still air.

Clue No. 6—Shunt Corrosion

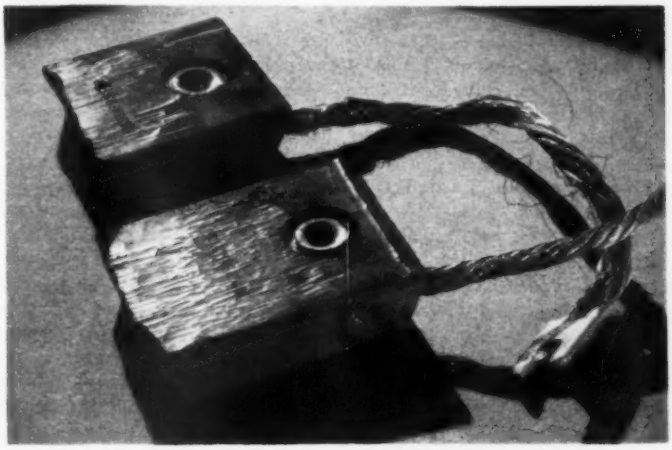
Equally as conspicuous as frayed shunts are those shunts which are corroded or oxidized, caused when the tiny wires are attacked chemically or are heavily oxidized due to atmospheric conditions. Corroded or oxidized shunts can be identified by their unusual color which will vary with the type of chemical attack.

Clue No. 7—Poor Connections

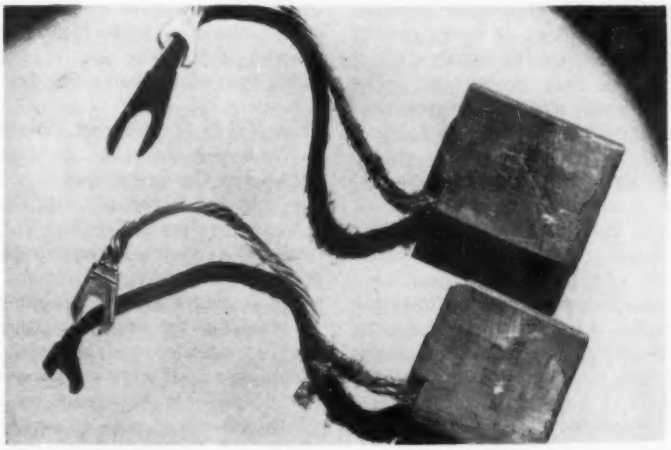
There are two methods by which shunts are commonly attached to



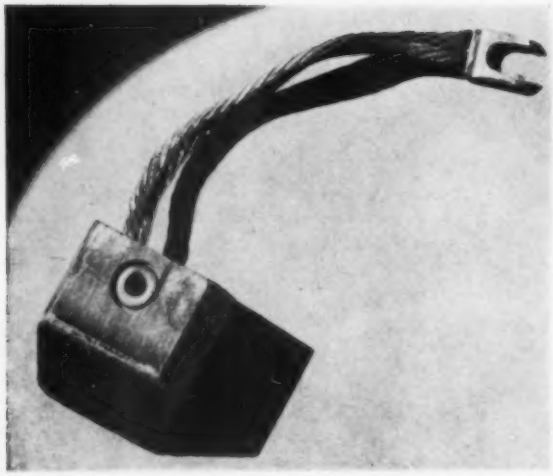
CHIPPED BRUSHES are easy to detect and they provide a useful clue for checking for severe chattering or brush movement. Chipping and brush breakage is generally accompanied by . . .



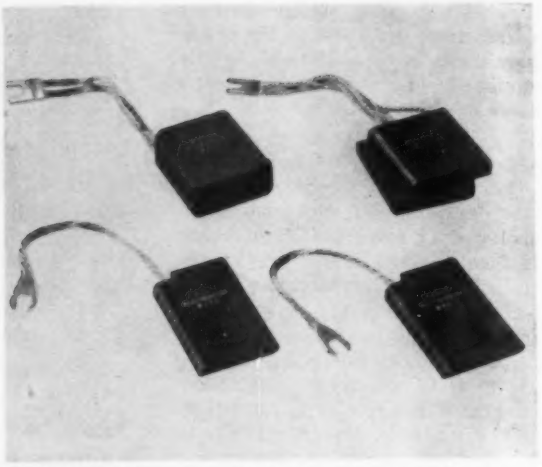
SIDE WEAR caused by the polishing action between brushes and the brush box. Wear marks appear as highly glazed areas and are due to the same general causes for chipping.



FRAYED SHUNTS are likewise easy to detect and they indicate excessive vibration of the brush in its holder or the imbrittlement of individual wires due to some type of atmospheric attack.



SPARKING along the edge of a brush is indicated by cloudy areas or by the presence of copper oxide. Variable symmetry of electrical or mechanical characteristics may cause this condition.



BRUSH SHUNTS can be attached by either tamped or riveted connections, tamped connections as shown above consisting of the wire imbedded in a hole drilled in the brush and held tight with a conducting cement.

brushes. One is called a rivet connection and the other is called a tamped connection. The rivet connection consists of a rivet threaded through the spread-out strands of the shunt wire and spun against a copper washer to assure a tight connection mechanically and a low millivolt drop electrically between the shunt and brush. On brushes such as split type brushes where it is necessary to use a metal plate (an "A" plate) the shunt is often attached under the same rivet that is used to attach the "A" plate. The tamped connection consists of the shunt wire imbedded in a hole drilled in the brush and held tight with a conducting cement in much the same manner a dentist fills a tooth.

To assure the best possible connection on Westinghouse brushes, each brush design is given a very rigid test before the brush style is authorized for production. The brushes are given a bench test which consists of passing current well above the rating through the brush and shunt to determine if there is any effect on the millivolt drop of the shunt connection. The more critical test is a vibration tester. The drop of the shunt connection is measured before the brushes are put on this tester with a very accurate bridge. The brushes are then put on the tester which consists of a drum 10 in. in diameter which can rotate at 1750 rpm. There are four steps of .050 in. each on the drum. The brushes are run on this tester over a wide range of speeds and for a period of time to set up conditions far worse than those that could be experienced on even the worst commutators in service. After the test has been completed the millivolt drops of the connection are again taken. The connection is not approved for production unless the millivolt drop between the start and finish of the test falls within a narrow range.

Clue No. 8—Failure of Spring Pressure

Brushes on which the spring pressure has failed usually have both the leading and trailing edges of the brush face rounded and pock marks on the brush face. This is caused by the sparking which occurs as the brushes flop around in the holders. Indications of the brush movement or chatter which caused the springs to fail are also present if the machine is investigated soon after the spring failure.

Clue No. 9—Two-faced Brushes

When the clearance between a brush and the brush box is excessive and the brush can tilt in the holder, the brush face has indications of a double fit with a high point about which the brush can rock. Double fits are most common on machines in reversing service, but they can also occur on machines which operate in only one direction. When a double fit occurs on machines which operate in only one direction it usually occurs after the brush is worn short enough to permit it to tilt in the holder.

Double fits represent high friction between the brush and the commutator, light spring pressure, improper brush or brushholder tolerance, brushholders which are mounted too far away from the commutator surface or distorted brushholder boxes.

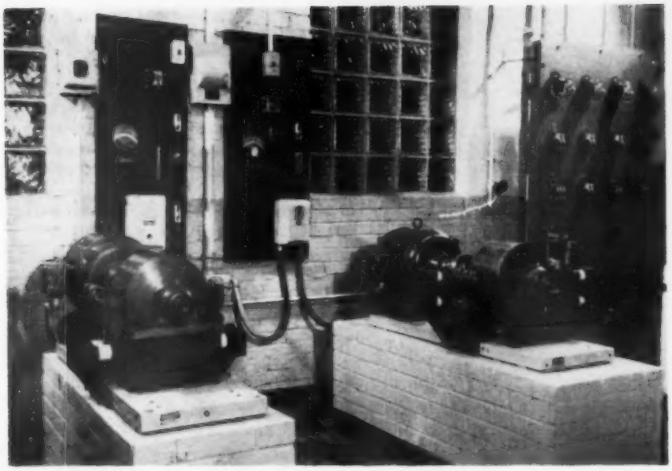
When a brush tilts in a holder to such a degree a double fit is present it is apparent that the entire brush face can not touch the commutator. This is effectively the same as putting a narrower brush on the machine and shifting the position of the brushes with respect to the neutral setting. Either one or both of these conditions disturb the electric balance of the machine and result in sparking.

Clue No. 10—Sparking

When brushes are sparking excessively there is usually evidence on the edge of the brush where the sparking occurs. This evidence is in the form of smoky or cloudy areas on the brush edge or in cases of real extreme sparking there may be some copper oxide on the brush edge.

Sparking also may occur under the face of the brush particularly if the brush shows a double fit as described above. When sparking occurs under the brush face there is a cloudy, pock-marked area and a nicely filmed area divided by a clearly defined line parallel with one edge of the brush.

Sparking can be caused by any one of the undesirable conditions mentioned above as well as vari-



VIBRATION TESTER consists of a 10-in. diameter drum which can rotate at 1750 rpm. Brushes are run over a wide range of speeds and time periods that create conditions far worse than would be encountered in even the severest of commutation service.

ables in the electrical or magnetic symmetry of the machine.

Clue No. 11—Copper Picking

Brushes which have been copper picking can be detected by particles of copper imbedded in the brush face. Copper picking is a cumulative condition which can start with a very small particle of copper and build up at a rapid rate being accelerated by the concentration of current which passes through that portion of the brush face. The current concentration is caused naturally since the contact drop between the brush and the commutator is lowest in that area of the brush face where copper is imbedded.

Copper picking can be started by a small amount of loose copper or copper dust which results from grinding the commutator, undercutting or beveling bars. This copper becomes imbedded in the brush face and continues to grow in size as it picks up copper from the commutator. Ultimately the commutator under a brush which has been picking copper becomes threaded or grooved but, copper can build up in the face of a brush even though the commutator is filmed.

Clue No. 12—Faulty Terminals

Maintaining good electrical connections is one of the most important points of a successful preventive maintenance program. Accordingly the terminals, shunts and shunt connections of carbon brushes should be regularly checked as part of any successful program.

High resistance shunt connections or open connections can result in poor commutation, selective action, excessively high temperatures or a combination of all three. Poor commutation and selective action if allowed to progress can develop into undesirable commutator conditions which require expensive grinding operations to correct.

Starting with the shunt terminals, the operator should first check to be certain that the slot or hole opening in the terminal is just slightly over the diameter of the terminal stud or screw. Oversize slot or hole openings in some types of terminals can permit the terminal to warp out of shape when the screw is tightened. The warping results in poor electrical connection between the shunt and the terminal block. Maintenance men can assure correct shunt terminals by purchasing style-number brushes engineered for specific machines.

On some terminal blocks of the type which requires a cap screw a condition can develop which is very difficult to track down. If for some reason it is necessary to replace the cap screw and the exact same length is not used or if the shunt terminal is changed to one that is not quite so thick, it is possible that the screw will bottom in the hole before full pressure is applied on the terminal. The light pressure on the terminal of course will cause a high resistant connection.

When installing new brushes the terminal block, shunt terminals and any screws and washers used should be inspected to be certain they are not oxidized or corroded to the extent the electrical resistance will be increased. If any parts appear to be corroded they should be dressed with a file. Corrosion of terminal blocks and related hardware should be watched for especially in plants where the atmosphere is likely to be contaminated such as paper mills and chemical plants.

Clue No. 13—High Resistance

Besides poor commutation, selective action and overheating failures which can occur when shunts and shunt connections are not performing 100%, there are some other conditions which frequently present themselves.

When the path for current flow from the brush to the terminal block becomes high in resistance, the current takes another route. Sometimes this route is out the top of the brush and through the pressure finger. When the current goes through the pressure finger, it invariably goes through the pressure finger spring. The heat generated by the current going through the spring causes the spring to anneal, and the pressure on the brush is reduced. This reduced pressure then causes selective action and overheating of the remaining brushes on the arm.

In extreme cases of failure of the electrical circuit between the brush and the terminal block the brush is effectively running at no-load. It is a well established fact that brushes running no-load develop a high friction film and brush chatter. For this reason brush chatter and brush breakage can also be considered a consequence of high resistance in the shunt circuit.

Uniform shunt paths are a must in the symmetry of commutation. A routine check of shunts, shunt connections and terminals should be included in every maintenance program.

Many dollars of repair expense can be saved by detecting slight variations in early stages before serious damage can begin, and it is in the interest of such detection and subsequent catching of commutation criminals that these tell-tale clues are presented.

Note: This discussion condenses a series of articles which appeared originally in "The Surface Rider" published by the Westinghouse Electric Corp., East Pittsburgh, Pa.

EXTERIOR of glass-brick-and-limestone building is evenly floodlighted by ground-based weatherproof units; upper facade is highlighted by canopy-mounted floods, while steps leading to entrances are illuminated by 16 R-38s recessed into underside of overhanging portico.

"Decorative functionalism" is evident in . . .

PROGRESSIVE LIGHTING DESIGN

. . . for this modern commercial building

Inside and out—combining special with standard fixtures—illumination plan for this impressive structure reflects quality engineering and installational craftsmanship.

VISITORS to Celanese Corporation's modern headquarters in Charlotte, N. C., will be impressed by the high quality and quantity of lighting treatments utilized throughout this imposing structure. In fact, even before people enter the front entrance, they note that the clean-lined architectural facade is effectively highlighted by dozens of ground-based and canopy-mounted floodlights, while front entrance steps leading up to all-glass doorways are brilliantly highlighted by many PAR floodlamps recessed into the underside of an attractive column-supported walk-overhanging portico.

This initial impression of progressive design is re-emphasized immediately inside the entrance, for the high-ceilinged (28 ft), expansive (50-by-36-ft), marble-floored-and-walled lobby utilizes lighting as a decorative as well as a functional medium. It combines such treatments as a 20-by-36-ft luminous ceiling beneath a balcony section; recessed downlights in a central suspended ceiling section, also along a full-height perimeter area; a 2-lamp continuous cove that dramatically emphasizes the transition line between these two ceiling heights, plus plexiglas-paneled 4-lamp recessed units interspersed along and beneath one wall-flanking stepped-shoulder section.

In this overall treatment, the luminous panel is backlighted by continuous rows of 8-ft T-12 warm white slimlines on 1-ft centers, with intensities beneath it averaging 100 footcandles and producing maximum peaks of 120. Warm white fluorescent lamps (four 24-in. T-12s on 9½-in. centers) are likewise used above the smaller plexiglas panels, while the annular-ring-baffled 150-watt downlights (set on 10-ft centers in both directions in the dropped-ceiling section, and positioned on 6-ft centers in the perimeter area) produce an average intensity of 15-fc (20 maximum) for general illumination purposes.

Another interesting area observable to the general public is a fabrics display room, where samples of Celanese products are exhibited in various large and small wall niches; one of which is top-lighted by a continuous row of translucent-panel-shielded 40-watt fluorescent lamps; another being illuminated from above by six 150-watt, and from either side by two vertical banks of five R-38-floodlamps contained in eyeball swiveling fixtures. Eyeball mounts, lamped with R-40s, also top-light a small niche positioned in one corner of this comfortably-furnished display room.

In the center of the room, a large walnut coffee table surrounded by maroon-upholstered sofas is highlighted by three annular-ring-baf-

SAMPLE ROOM displays fabrics in side- and top-lighted wall niches, while central table and furniture arrangement can be lighted to maximum intensity of 130-fc by utilizing three 150-watt downlights plus surrounding slimline-backed plexiglas oblong panel arrangement.

LUMINOUS ceiling beneath balcony section, suspended central ceiling with baffled downlights, continuous cove-lighting to accent 2-level main ceiling patterns, plus smaller luminous panels beneath left-hand stepped wall are features of the lighting plan in this attractive clean-lined marble-faced lobby.

DIRECTORS' conference room features specially-designed suspended canopy consisting of 3-ft-sq translucent plastic panels framed and supported by massive (4-in.-wide) grid members. Lighting intensity on central table approximates 70-fc, while minimum levels along wall lines average 50.

fied R-38 150-watt floods, plus a surrounding luminous oblong containing a total of 16 8-ft T-12 warm white slimlines behind T-bar-supported 2-ft-sq diffusing plastic panels.

Completing the lighting treatment in this cream-walled display center is an architectural outwards-and-upwards-slanting cove containing a single row of 4-ft WW T-12s mounted end-to-end.

Intensities (on displays, table, lounge sofas, etc) range between 130 and 40 footcandles; the average in the room being approximately 80.

Still another interesting lighting technique is to be found in the directors' conference room, where a specially-designed-and-fabricated luminous panel, suspended above a massive conference table, is wired for 2-level switching to provide either 50 or 70 footcandles of shadowless, diffuse lighting to the top of the table. The panel, consisting of 3-ft-sq translucent plastic panels supported by a 4-in.-wide grid framework, also provides a wealth of bounce-light from a white acoustical plaster ceiling and light-toned natural-wood panelled walls.

A bit less spectacular, yet no less functionally efficient, is the lighting of such business areas as those used by executive secretaries, general office personnel, draftsmen and the like; several of these areas being pictured in accompanying illustrations on the next page.

As indicated, the executive secre-

DRAFTING tables obtain average of 80 footcandles from 4-lamp Holophane-lensed 2-ft-wide continuous fixtures mounted on 10-ft centers. Lamps used in fixtures over drafting area are 96-in. T-12 warm white tubes.

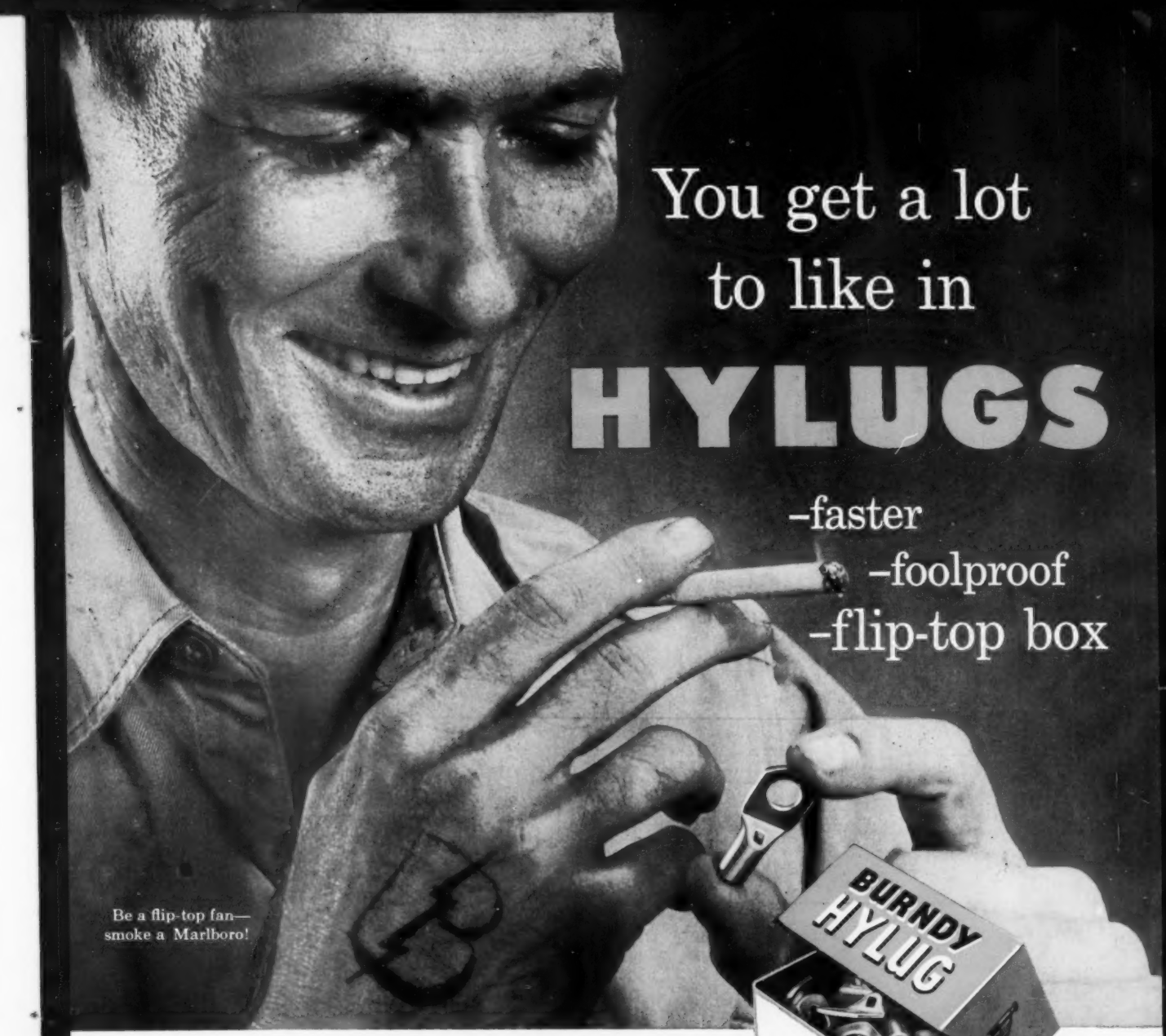
tary area (with white ceiling, cream walls and green carpeted flooring) is lighted by two mediums; a continuous line of 4-lamp Smithcraft plexiglas-panelled recessed fixtures containing 96T12 WW lamps (positioned directly above desks), plus a series of recessed downlights (on 10-ft centers) as a light-balancing factor over a flanking aisle section.

Two treatments are likewise used in general office and drafting areas, where side aisles are illuminated by 2-ft-sq 4-lamp recessed units installed on 10-ft centers, and where office-desk and drafting-table areas are lighted by continuous 2-ft-wide recessed troffers (also installed on 10-ft centers) which are lamped by 4 rows of 8-ft slimlines. All lamps are warm white in color, while diffusing panels consist of special Holophane lensed plates. Illumination on desk tops average from 80 (for drafting) to 65 (for office work) footcandles, while minimum values at floor level half-way between aisle units are approximately 45-fc.

This installation was wired by the White Electric Construction Company in accordance with lighting plans prepared by electrical engineers Biberstein, Bowler & Meacham of Charlotte, N. C.

EXECUTIVE secretary area is primarily illuminated by continuous luminous section (consisting of 12 8-ft 4-lamp plexiglas-paneled fixtures mounted end-to-end), with downlights on 10-ft centers above flanking area.

OFFICES utilize fluorescent fixtures equipped with Holophane lensed plates as diffusing medium; lighting mediums taking the form of 2-ft squares (above aisle) or continuous 4-lamp troffers (above desks).



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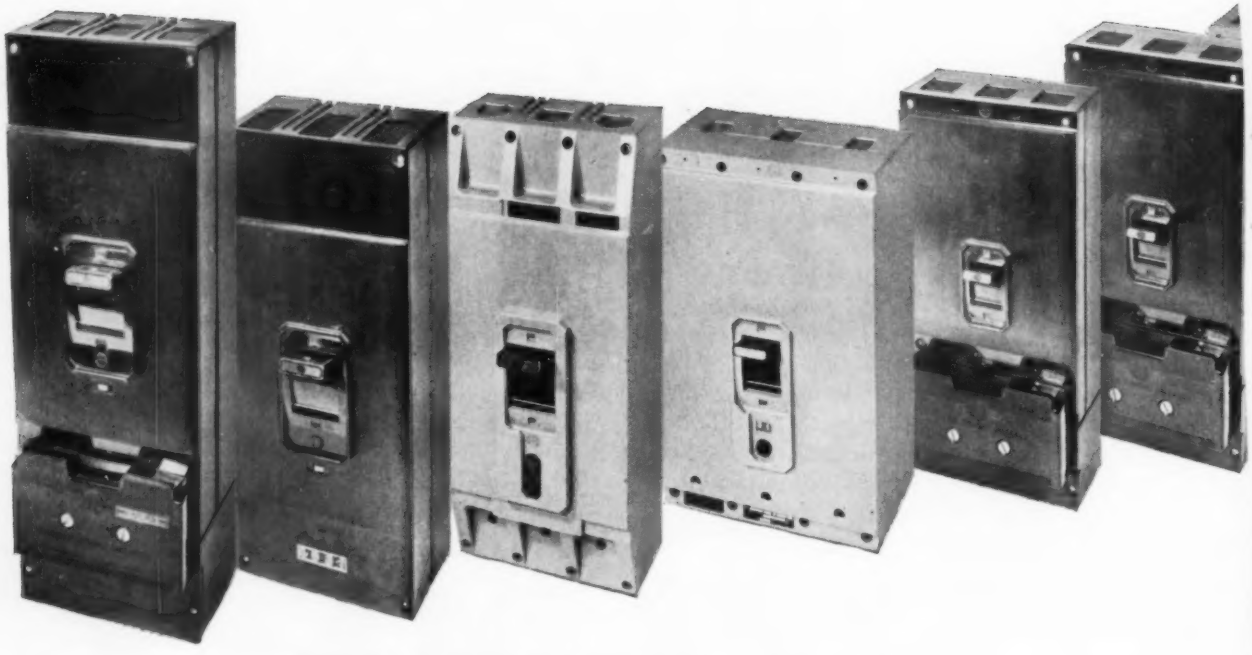

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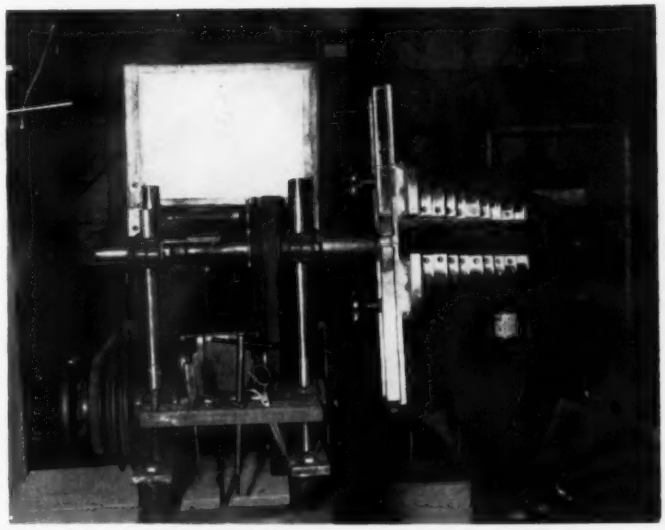
Motor Shops

Coil Winding Machine Has Tension Compensator

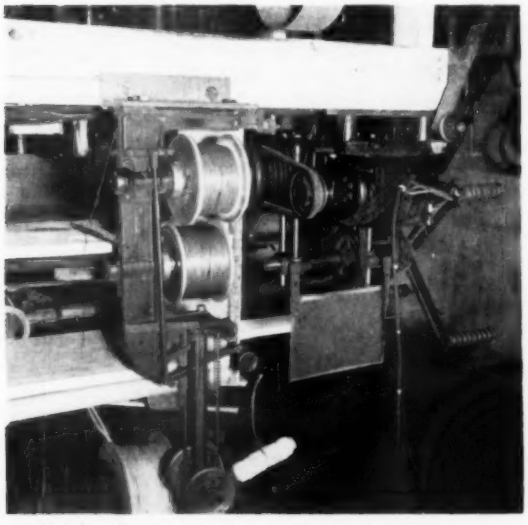
Motor shops in two widely-separated sections of the country are related to the coil-winding rig discussed here. The original comments and photographs concerning its use were brought to our attention by the Raymond Motor Shop, of Venice, Fla., but shop-owner Lawrence Raymond gave full credit for making the equipment to Chris Dulsen, owner of the Central Electric Company in Cambridge, Mass.

Fundamentally, the assembly combines several elements for maintaining uniform tension on coil wire, several intermediate sheaves for changing direction of wire travel, a foot treadle for controlling drive-motor operation, several pulley combinations for varying the speed of rotation, a slotted index plate to keep wire tangential to the steps of various winding heads, a geared revolution counter, and a conveniently-placed chart containing winding reference data.

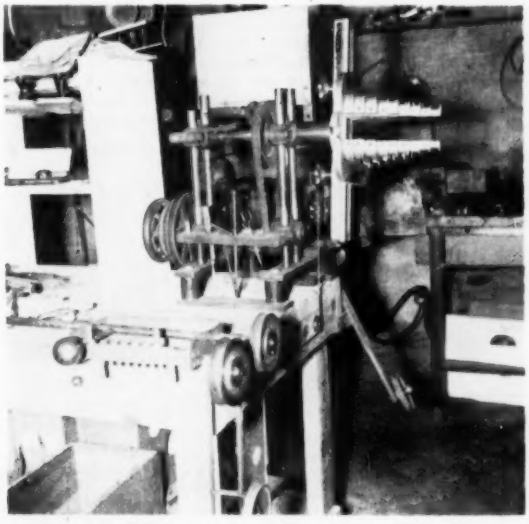


SPEED OF HEAD is regulated by shifting belts on multiple-diameter pulleys; also by shifting brushes on drive-motor commutator. Brushes are shifted or motor is stopped instantly (by Micro switch) by applying or releasing pressure on foot treadle. Chart mounted adjacent to winding machine contains useful coil-winding data for reference of operator.

More specifically, tension is regulated by two main spring-loaded sheaves located directly above two take-off wire spools; a third spring-loaded pulley mounted below the final wire-alignment sheaves; soft leather friction drums on spindles of take-off spools plus small brakes which are mechanically controlled by the compensating action of spring pressure; and a rod-linked weighted idler sheave that rises or falls as wire tension increases or decreases. Therefore, as noted in the accompanying illustration, if one of the take-off spools revolves too fast (in relation to the speed of take-up on the winding head) the weighted, pivoted idler sheave drops, causing the rod-linked control brake to exert pressure on the drum of the corresponding spool spindle. And, if a take-off spool re-



TAKE-OFF SPOOLS of wire are mounted on two separate spindles beneath spring-loaded tension sheaves. Weighted idler sheaves are rod-linked to small brakes that exert upward pressure on soft leather drums which are mounted on spool spindles.



INDEXING PLATE makes it possible to move the final lead sheaves laterally by raising, shifting and dropping the ball-weighted shaft-adjusting lever. Notches of index plate correspond in alignment to stepped grooves of coil winding head so that wire is tangential to the proper coil form at all times.

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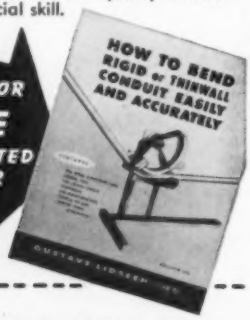

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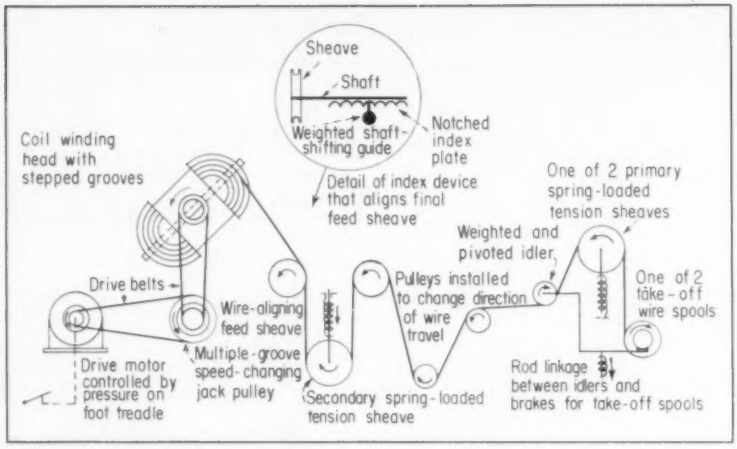
Sheave
Shaft
Weighted shaft-shifting guide
Notched index plate
Coil winding head with stepped grooves
Detail of index device that aligns final feed sheave
One of 2 primary spring-loaded tension sheaves
Weighted and pivoted idler
Drive belts
Pulleys installed to change direction of wire travel
One of 2 take-off wire spools
Wire-aligning feed sheave
Multiple-groove speed-changing jack pulley
Drive motor controlled by pressure on foot treadle
Secondary spring-loaded tension sheave
Rod linkage between idlers and brakes for take-off spools

SCHEMATIC SKETCH of assembly shows relation, although not accurate dimensions or details, of spring-loaded tension pulleys, idler sheave and rod-linked brake, intermediate sheaves for changing direction of wire travel, belt drive for winding head, detail of indexing plate and operation of foot treadle related to operation of drive motor.

volves too slowly (with a corresponding increase of tension), the idler sheave rises and the rod-linked brake releases pressure so that the unreeling speed will automatically be adjusted.

When wire eventually leaves this train of tension-regulating and direction-changing sheaves and proceeds to the head of the coil-winding machine, exact alignment of wire with various grooves of the stepped winding head is obtained by laterally shifting the position of the final feed sheave. This is done by lifting, moving and dropping a weighted shaft-adjusting guide into various slots of a notched indexing plate; the notches of the plate corresponding in alignment to the related stepped grooves of the winding head.

As to the order of speed at which the winding head rotates, practically any desired velocity can be selected by shifting the commutator brushes of the one-third hp variable-speed (up to 1750 rpm) drive motor, and by changing the basic reduction ratios between motor- and winding-head shafts. Commutator brushes are shifted by the action of an arm which is linked to a foot treadle, while primary speed ratios are changed through the medium of shifting drive belts to various steps of multiple-diameter pulleys which are placed variously on the shafts of the drive motor, the winding head and on an intermediate jack shaft.

Shutting the motor off completely is accomplished by releasing pressure from the foot treadle. A Microswitch then stops the motor instantly — another very desirable factor contributing to fast, accurate coil winding.

Number of turns of wire on the head is noted continuously by a revolution counter geared directly with the shaft of the winding head so that, if coil turns are either added or removed, the counter will correspondingly progress either forward or backward to keep the count accurate.

As a final aid in promoting coil-winding efficiency, a coil-turn chart is conveniently mounted adjacent to the winding machine for fast reference. Horizontal columns on this chart are headed by Number of Turns, while vertical rows list the multiplied progressions of these numbers. For example, columns are headed by numbers running from 13 to 55 (turns), while (under the column headed by No. 13, for example) the multipliers appear as 26, 39, 52, 65 and 78.

In explaining the many details of this assembly, Lawrence Raymond admits that "it is evident that the rig has a distant relationship to Rube Goldberg, yet it is just about the most useful tool I have in the shop".

Vapor Degreaser Cleans Motor Parts

Cost reduction while still maintaining, or even improving, quality of workmanship is a goal all motor repair shops seek. As a result, enterprising shop men are constantly analyzing their own operations and looking for new materials, equipment and techniques.

with National Electric Xduct Junior, E.M.T.

Only high ductile steel is used in the manufacture of Xduct Junior, E.M.T. The result—you can make bends easily without using excessive pressure. In addition, you'll find that properly handled, Xduct Junior does not flatten and the tight finish will not flake or crack. Good bending is just one Xduct Junior feature. You also get—

Easy Fishing—Xduct Junior has a baked-on inside coating of aluminum enamel that holds friction between conduit walls and wires to a minimum.

Corrosion Protection—National Electric's revolutionary process of electrogalvanizing deposits pure zinc uniformly over the entire outside surface of the E.M.T. . . . assures high resistance to corrosion.

If you're looking for fast installation and complete wiring protection, try National Electric Xduct Junior on your next job.

A screwdriver is all you need with National Electric E.M.T. Fittings

The outstanding holding action of these fittings is obtained when the patented embedding screw is driven home in the tubing wall. Actual tests prove the connection is a vibration-proof bond that won't break or loosen unless the screw is purposely released.

Patent No. 2,455,180

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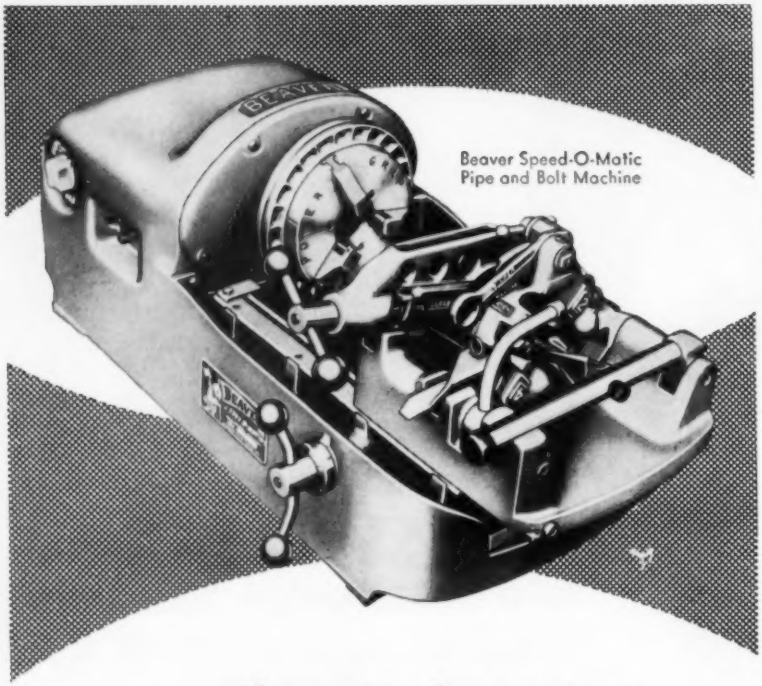

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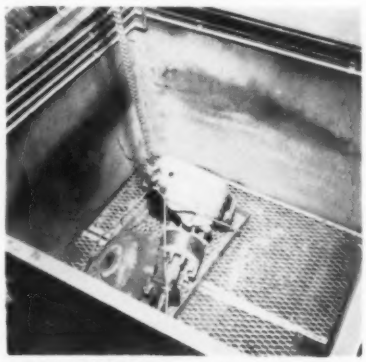
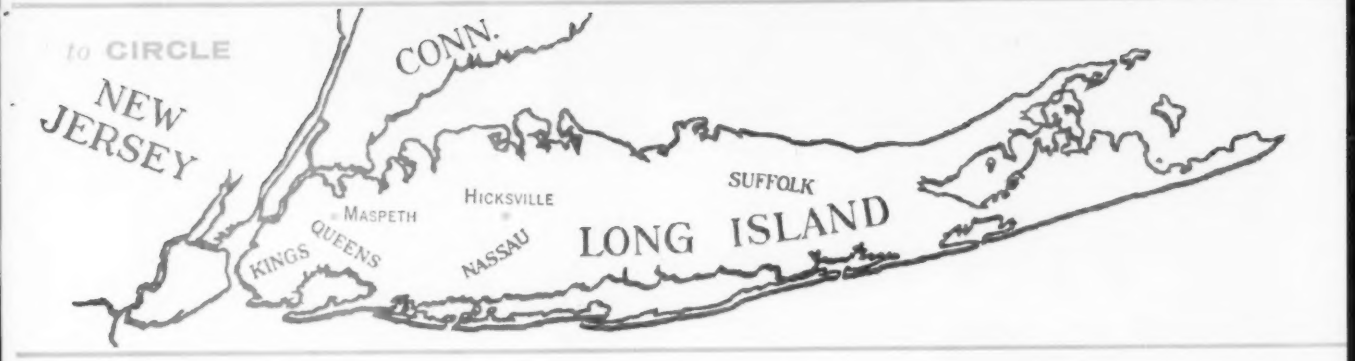
VAPOR CLEANING tank designed and built at Lansing Electric Motors shop incorporates degreasing compartment (rear with hinged cover) and circulating cold water reservoir (front). Electric hoist lowers tray load of motor parts into vapor tank.

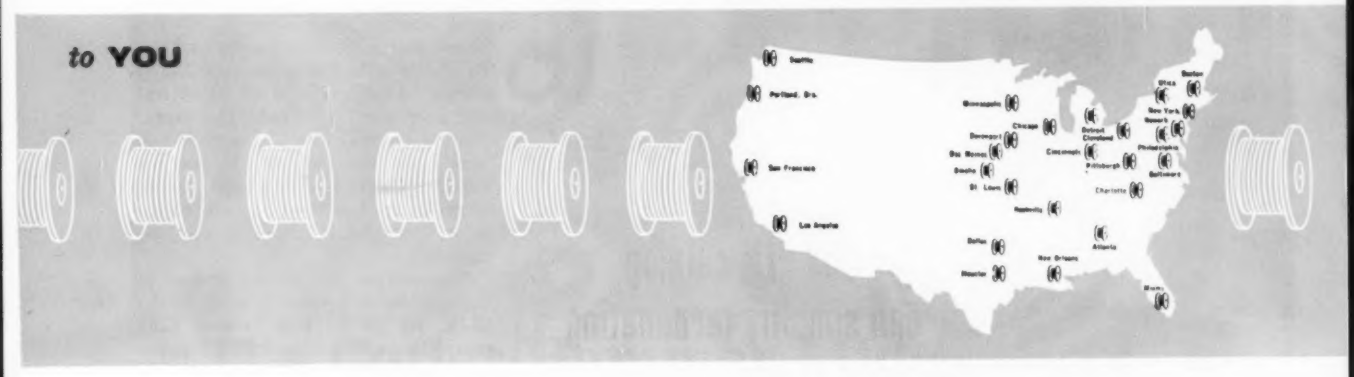


TANK INTERIOR showing cooling coils (top) and tray of parts resting on metal grid support above solvent level. Four 2500-watt immersion heaters vaporize solvent during cleaning cycle.

Parts cleaning was just one of many shop operations coming under the critical scrutiny of Fred N. Selby, Lansing Electric Motors, Lansing, Mich., partner in charge of motor repairs. The net result of his searching investigation was the design and construction of a vapor degreasing tank and process using Trichlorethylene (metal degreasing grade) as the volatile solvent cleaning agent. Since this method has been put in use, L-E-M shop management has been able to save up to $20 per day on parts cleaning alone. Previously, a brush and spray operation with a liquid detergent was used.

The vapor-cleaning tank itself is 4 ft sq and 4 ft deep; is constructed of 16-gauge steel on a 1½-in. angle-iron frame. A hinged cover confines the vapor within the tank during the cleaning cycle. About 4 in. (15 gals) of solvent is kept in the bottom of the tank. This is heated, until it vaporizes, by four





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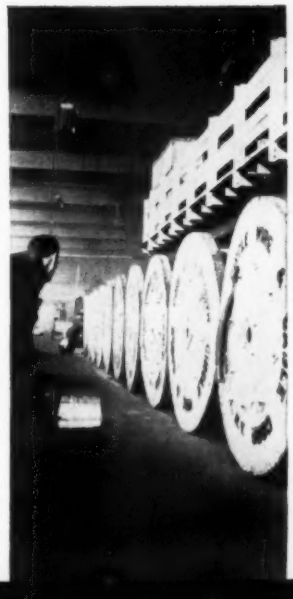
At Circle's huge plants, these bars are converted into one of the country's broadest lines of quality building wire and cable. Strict controls insure that every foot of wire and cable is as perfect as can be before shipment to a vast country-wide network of distributors.

Quality line, ample stocks, all-out service: these are why more and more contractors agree that working through a Circle distributor is their best assurance of adequate, available supplies. Next time you need wire or cable, say Circle – many other satisfied contractors do.



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Planning
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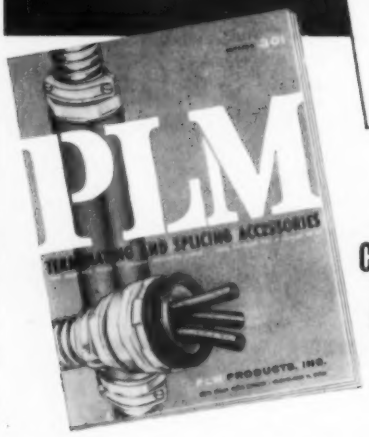
INSTALLATIONS?



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No need to write detailed orders or specifications for materials for splices or terminations! PLM Unit Package Kits each contain all materials needed for a correctly designed joint or termination, together with detailed instructions.

Catalog lists kits and fittings for both open interlocked and new sealed-type armored cable, for non-metallic jacketed cable and for lead-covered cable through 23 kv. Fittings include through type, bracket, flange-mounting and compound-filled terminators and 2, 3 and 4-way splice joints. Write for copy. PLM Products, Inc., 3875 W. 150th St., Cleveland 11, Ohio.

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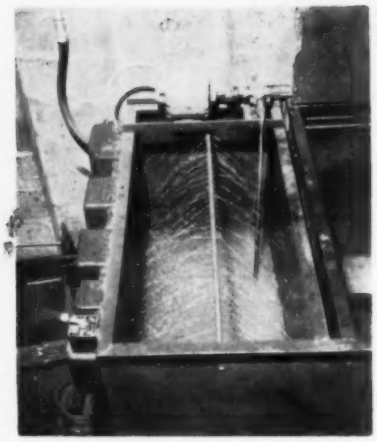

WATER RESERVOIR is adjacent to vapor tank. Cooling water is drawn by pump from bottom of tank, circulated through vapor-tank coils and returned through spray tube at top of water tank.

2500-watt immersion electric heating elements connected in series on a 440-volt, single-phase, thermostatically controlled circuit.

Expanded-metal parts trays are supported by a substantial metal grid above the solvent level. Between this supporting grid and the solvent is a fine, window-type metal screen to catch the small paint and dirt particles loosened by the vapor. During normal use, the screen and tank are cleaned about once a month. Large stators and rotors as well as small parts and accessories can be cleaned in the degreaser.

Constructed as an extension of the degreaser proper is a 48-in. by 48-in. by 22-in. wide water tank complete with circulating pump and aerating tube. A 1¼-in. air space insulation separate the two tanks. This is an important accessory to the degreasing operation. The 40 to 50 gals of cooling water is pulled from the bottom of the tank and circulated around four parallel rows of ½-in. copper tubing installed around the top interior of the vapor tank. The water returns to its own tank through the 4-ft long spray tube bridging the length of the tank.

These cold water coils keep the top of the vapor tank about 2 degrees cooler than the rest of the enclosure and help confine the detergent vapors. When the vapor (heavier than air) rises and hits this cold strata, it tends to go back down to the bottom where the parts trays are. Also, the vapor condenses more rapidly after the cleaning cycle is completed.

Normally, it takes about one-half hour to thoroughly clean a tank

IT'S BUILT RIGHT– IT WORKS RIGHT– IT'S PRICED RIGHT

The Cutler-Hammer Midget Switch

Many electricians are now using this amazing Cutler-Hammer 4151 Midget Safety Switch wherever low cost circuit protection and control of electrical equipment is required . . . oil burners, air-conditioners, fans, automatic washers and dryers, home workshop power tools, blowers, and stokers are typical examples. Try a 4151 on your next job and you will agree this midget safety switch is built right, it works right, and it's priced right.

It's built right—Everyone is quick to appreciate the 4151's compact design, but of equal importance is its ease of installation. The one piece switch-and-fuse unit is removable by two screws for 3-point mounting of the enclosing case, speedy conduit connections, and wire pulling freedom. All terminals are out-front . . . no more skinned knuckles or wire "pretzel" bending.

It works right—Cutler-Hammer's 4151 Midget Safety Switch has solid silver, double break, butt type contacts. Silver contacts will outlast contacts of copper or bronze. Double break contacts have greater contact area and halve the arc voltage. Butt type contacts meet face-to-face and receive only a fraction of the wear common to other designs.

It's priced right—The 4151 is a quality safety switch, yet the price range is the same as the cheapest switches made.

Ask for a Cutler-Hammer 4151 Midget Safety Switch today. Stocked by your Authorized Cutler-Hammer Distributor and better electrical supply stores everywhere. CUTLER-HAMMER Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

4151H241 30 Amp. 2 wire S/N; 1 Fuse. 120 A-c. 2⅛" x 5⅛" x 2¼". List: $5.00

4151H201 30 Amp. 2 Pole; 2 Fuses. 120/240 A-c. 4" x 5¼" x 2¼". List $6.20

EXTRA VALUE
CUTLER-HAMMER
SAFETY SWITCHES
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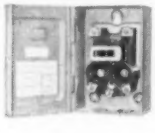
AT NO EXTRA COST



4151H341 30 Amp. 3 wire S/N; 2 Fuses. 120/240 A-c. 4" x 5¼" x 2¼". List: $6.50

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FOR POWER AND CONTROL CABLES
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Don't COMPARE MATERIAL COST

Do COMPARE INSTALLED COST

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Design and layout assistance available. Unit responsibility assumed. Over 3000 completed installations — Send for free catalog.

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5300 VINE STREET, CINCINNATI 17, OHIO

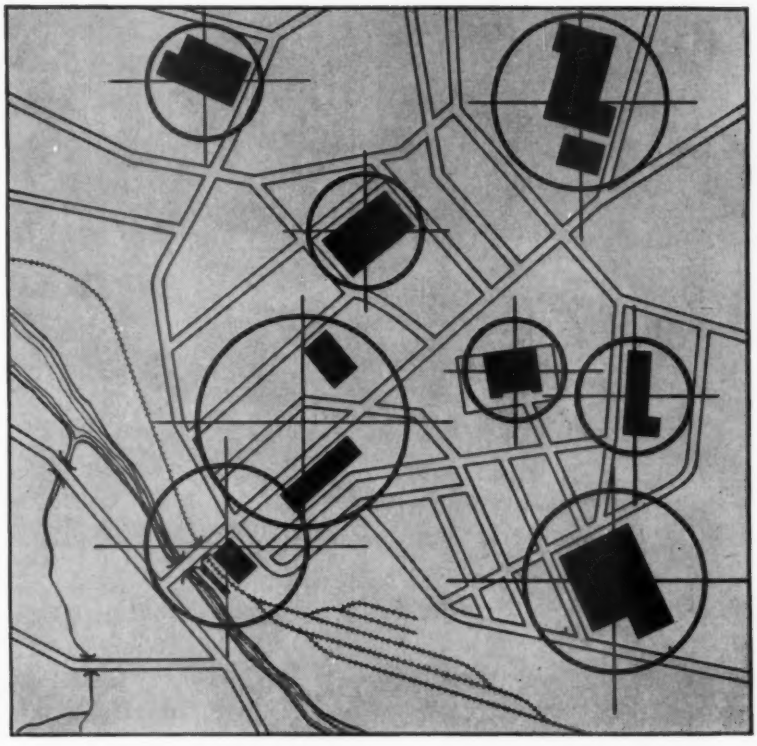
PRESIDENT OF NISA's Quaker City Chapter is Bob Swanson who also operates the Electric Motor Service shop in Kennett Square, Pa. Here the camera catches him calling a customer's attention to name-plate data on a unit just purchased.

load of motor parts. This may vary plus or minus 5 or 10 minutes depending on the condition of the parts to be cleaned and whether or not paint is to be removed. Should any paint or dirt particles still adhere to the metal parts after the vapor-cleaning cycle, they can be washed off with a detergent spray. A nozzled-hose and electric circulating pump on the outside of the vapor tank provide a pressure spray of the condensed solvent from the bottom of the vapor tank.

Shop supervisor Selby is more than pleased with the improved quality of parts cleaning and the substantial saving in time provided by this method. One big advantage is the fact that men are released for other work in the shop during the cleaning cycle. Only when the tank is loaded and unloaded need a mechanic be present.

SHOP FOREMAN Jack Tomlinson of S&M Motor Repairs, Trenton, N. J., wheels another motor into his bake oven during a typical day's routine of serving industry.

EXIDE DECLARES WAR



The target area. Look for the enemy in every store, school, office building, factory, restaurant, hospital, institution, theater, or other building where people congregate. There are hundreds of them in your locality.

Launches all-out attack on sudden darkness in 1958. Thousands of victims need Exide Lightguard*

1958 will witness a full-scale, concentrated Exide advertising campaign aimed at bringing relief to the big majority of your customers who still suffer from the risk of sudden darkness.

It will have two primary goals

1. **Alerting them to the danger of sudden darkness so it will be easy for you to sell them Exide Lightguard.**
2. **Sending them out to look for the dealer who has Exide Lightguard in stock for immediate delivery.**

This campaign is being waged to help you. Make sure you are ready to benefit from it. Sell Exide Lightguard to the hundreds of customers in your area who desperately need protection from sudden darkness. Stock up now. For complete details, send coupon.

*Lightguard is an Exide trademark, Reg. U.S. Pat. Off.

The weapon. Exide Lightguard Emergency Lighting Units. They kill sudden darkness instantly, automatically. Portable. Easy to set up. Most of your customers will want several. Distribute freely. Exide can supply all you need.

Infiltration tactics. During the year 1958 Exide will slip over 5 million advertising messages right past the most alert secretaries to help make your selling job easier. Doors will be opened to you . . . many customers pre-sold.

Exide INDUSTRIAL DIVISION
The Electric Storage Battery Company, Phila. 2, Pa.

How can I become a dealer for Exide Lightguard?

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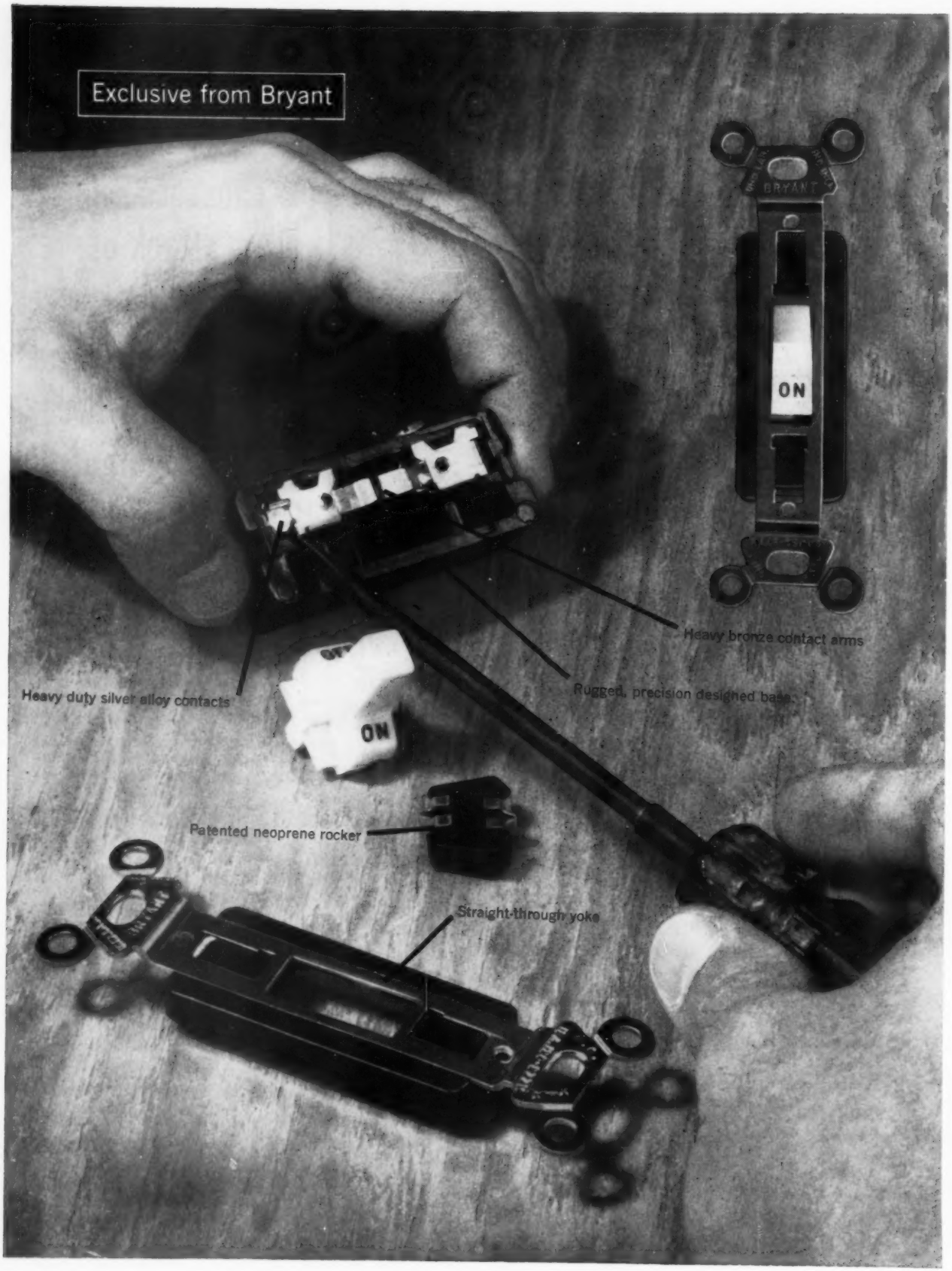
16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BRYANT
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Heavy bronze contact arms
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ON
Patented neoprene rocker
Straight-through yoke

WE TORTURED THIS SWITCH

1,000,000 Operations at Full-Rated Capacity . . . and It Was Ready for More!

You can't beat this switch for durability. Install it! Forget it! This switch will be giving faithful service when they tear down the building.

The secret is in Bryant's exclusive action and extra-durable construction. Bryant's patented neoprene rocker and toggle cam design gives this switch slow break . . . maximum closure speed . . . controlled breaking action. This means less arc, less sizzle, no contact bounce. And there are no coil springs inside to weaken or fail. You'll get a controlled contact opening to aid arc rupturing.

Look at the carefully engineered plastic base. It holds parts in perfect alignment . . . seals out dirt and dust. Heavy bronze contact arms insure positive pressure between the silver alloy contacts.

Bryant A-C Switches will handle up to full rating of tungsten or fluorescent loads, filament loads, resistant and heating loads and motor loads up to 80% of rating.

Bryant offers a complete line of quiet A-C Switches with these exclusive features . . . both residential and commercial grades. Single-pole, double-pole and 3-way. Ratings of 15 and 20 amp . . . 120 or 277 volt.

These A-C Switches are part of Bryant's complete line of top quality wiring devices. You can wisely choose Bryant for every device . . . on every job you wire. Bryant devices not only meet, but exceed Government and Underwriters' Laboratories standards. Make Bryant first choice . . . there's no need to change brands or distributors from job to job.

Ask your Bryant Distributor for more information about Bryant quiet A-C Switches. Let him supply all your needs with Bryant superior wiring devices.

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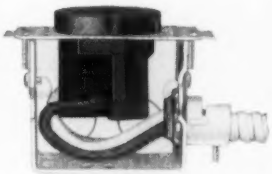
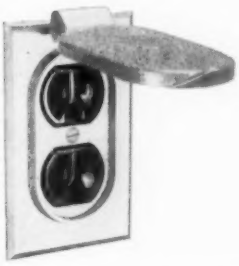
Grounding devices with exclusive breakaway grounding slot.

Duplex outlets with self aligning contact grips.



Range and dryer receptacles in both 50 and 30 amp ratings.



Universal weather-proof covers for outside receptacles.

Practical Methods

Compression Connectors Approved for Use on Vertical Risers

INSTALLATION

For the purpose of connecting solid No. 10 leads (related to 1875 apartment fuse panels) to vertical 208-volt, 3-phase, 4-wire No. 1 or No. 2 power risers in the N. Y. C. Housing Authority's $18-million Marlboro House project, C-type Crimpit compression connectors were manually installed with the use of a lightweight Hytool. According to electrical foreman Ted Wall, this was the first project in N. Y. C. to receive the Housing Authority's approval for this type of connection. He also stated that, when taped, these compression joints had diameters no larger than the ODs of the insulated riser cables, and that electricians could install two connectors of this type in less time than it formerly took to make one split-bolt connection. As a result, connections conserved time and energy, while the completed taps were compact, neat and workmanlike in appearance.

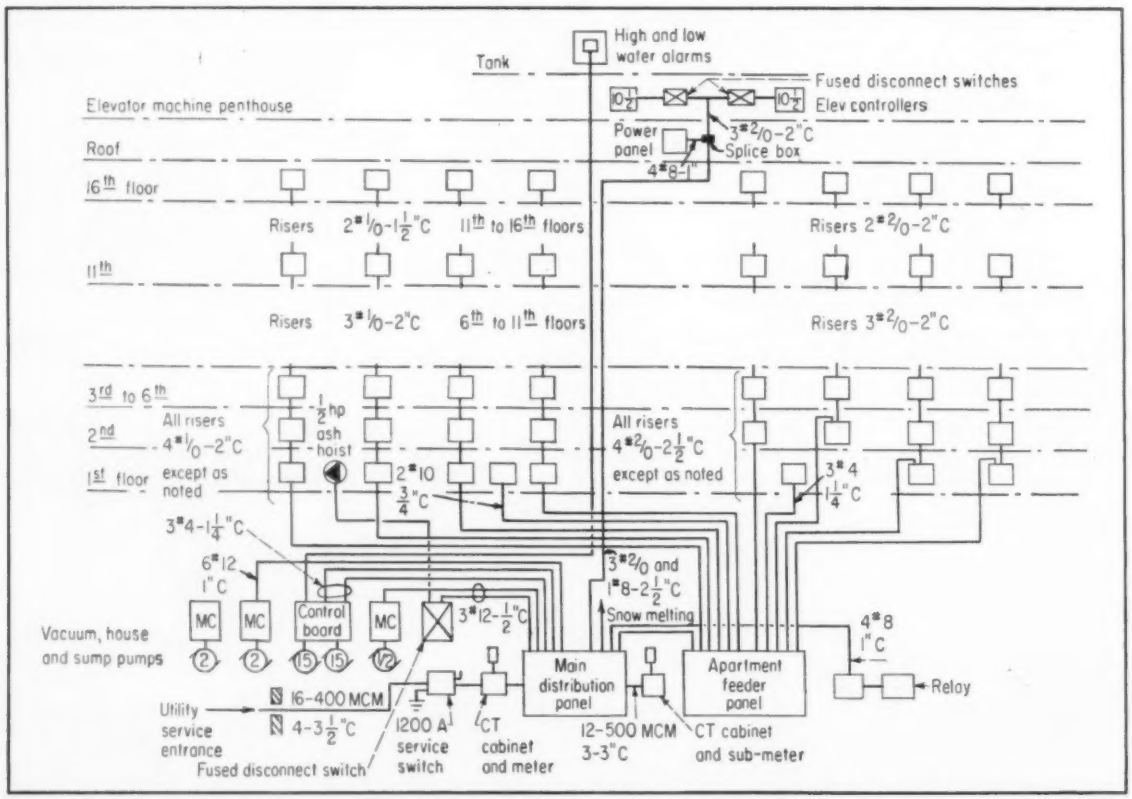
Other "firsts" on this project included (1) the use of open balconies on exterior faces of the buildings to serve as public corridors, (2) the installation of nickel-chromium resistance cable in conduits embedded in these exterior balcony slabs to preclude the accumulation of snow, ice or water, (3) the installation of electric ranges in all apartments, (4) time-clock-controlled roof-exhaust fans to ventilate interior hallways and baths, (5) exterior and balcony lighting likewise master-controlled by centrally-located time-clocks, and (6) electric hoists to enable maintenance men to raise boiler ashes from the basement to the ground level.

This large-scale housing project includes 29 fireproof buildings, three of them being 16 stories in height while the remainder are seven stories each. The electrical contract, exceeding $1-million and awarded to Nager Electric Co., of Brooklyn, N. Y., included over 300 miles of branch circuit wiring and 130 miles of rigid steel conduit. Mechanical engineers on the job were Meyer, Strong and Jones; structural engineers were Severud, Elstad & Krueger, while the architects were Harrison and Abramovits.

Change Order Forms

MANAGEMENT

Many of the changes and extras that occur on jobs are requested at the project site, while work is in progress. The owner, architect, or general contractor may insist on a change when it is impossible for the electrician to contact his foreman, superintendent, or office. For this reason, it is necessary for the workman to proceed with the change at once, in order to prevent loss of time, or just to be able to keep ahead of the general construction.



PARTIAL RISER diagram shows 1200-amp service entrance, main distribution panels, riser details and location of motorized equipment in this 16-story apartment building. Electrical contract on this project exceeded $1-million, while over 300 miles of branch wiring were installed.

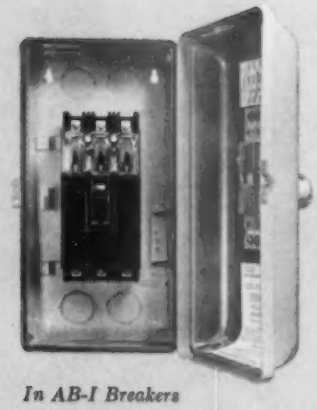
from Westinghouse

LOOK

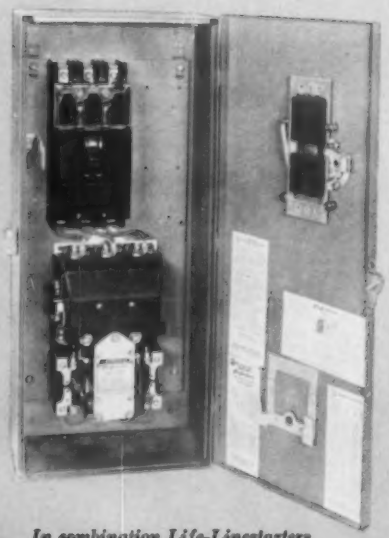
the contacts are visible!

SAF T VUE

WORLD'S FIRST BREAKER WITH CONTACTS VISIBLE



In AB-I Breakers



In combination Life-Linestarters

Safe, Sure, Protection

They're calling it "the biggest thing in circuit protection since Westinghouse developed the breaker!" You can *see* the contacts are open, or closed, through the heat-resistant thermoplastic window. Yet the breaker is still dead-front, with no exposed live parts.

What's more, the transparent window won't cloud during repeated full-load switching or interrupting—won't cloud even on normal overload interruptions.

In case of a high-value short circuit, the Saf-T-Vue breaker window clouds immediately —giving you visual warning of serious trouble on the line. In this rare instance, the transparent window can be easily and inexpensively replaced.

SAF T VUE *in Westinghouse AB-I Breakers*

Good news for steel mills, automotive plants, *all industry*—Saf-T-Vue is available in Westinghouse AB-I breakers in sizes F through LM. And you can get them in enclosures for every conceivable application.

SAF T VUE *in Westinghouse combination Life-Linestarters*

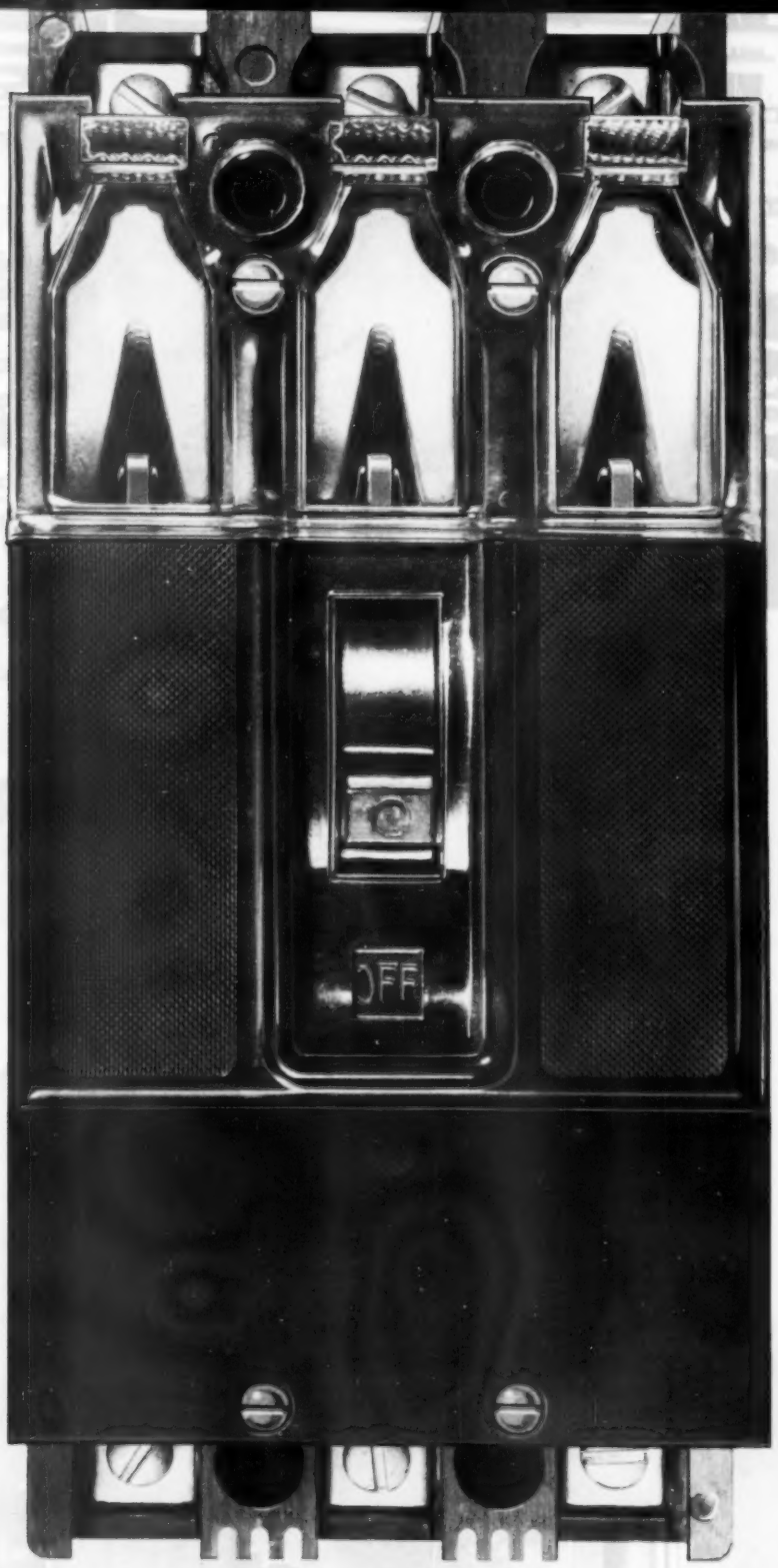
In combination Life-Linestarters*, too! Saf-T-Vue Breakers add one more "plus" to a long line of Westinghouse exclusive features: all front-removable parts; positive De-ion® arc quencher; bimetallic disc overload relay; knife-edge fulcrum that prevents armature sticking or binding; and many, many more—

For complete information on this exciting new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Penna.

*Trade-Mark

JI-30289

YOU CAN BE SURE...IF IT'S Westinghouse



Westinghouse Electric Corp.
STANDARD CONTROL DIVISION
Beaver, Penna.

SPECIFY QUALITY . .

insist on McGILL®

The toughest industrial sockets made—

McGill LEVOLIER phenolic and brass sockets have the quality needed to withstand the hard use and abuse of industrial service. Important to you is the saving these sockets offer by eliminating frequent replacement of ordinary sockets.

They are built heavier to last longer with .006" heavier screw shells, double thick molded phenolic casings and the famous LEVOLIER switch mechanism. 660 watt, 250 volt with push button, molded lever or universal pull lever control.

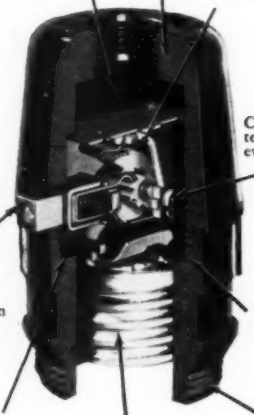
No. 4403-PB single circuit, 660 watt, 250 volt socket with ⅜" cap and shade threads. Double thick impact resisting cap and casing of molded phenolic screws together for easy wiring and assembly. Molded lever and push button adaptation of LEVOLIER switch mechanism. Perfectly insulated with no exposed metal.

No. 4403-FL single circuit, 660 watt, 250 volt socket. LEVOLIER switch mechanism with molded lever control. ⅜" cap, shade threads. This and 4403-PB especially adaptable to machine lighting.

No. 4303-PL single circuit, 660 watt, 250 volt socket. Molded phenolic case with ⅜" cap. Molded phenolic case without shade threads. Plain brass lever.

No. 4100 single circuit, 660 watt, 250 volt brass socket with ⅛" cap and casing that screws together with a locking collar and prevents accidentally snapping the sections apart. Universal pull lever and chain.

No. 4120-PB two circuit, 250 watt, 250 volt for two filament bulbs. Sequence of operation is High, Medium, Low and Off. ⅛" cap. Push button control. Available in molded phenolic also.


Ample space above mechanism permits tieing Underwriters' knot.
Extra heavy shell of impact resisting molded phenolic
Special alloy of high conductivity bronze for switch contacts.
Convenient side terminals avoid uneven wire lengths.
Red plastic button to actuate new push type mechanism.
Upper and lower halves screw together for easy assembly.
Mechanism rigidly supported in shell.
Lamp base screw shell .006" heavier than standard.
Shell completely insulated with no exposed metal.
Approved by Underwriters' Laboratories Incorporated.

FREE! For complete information on McGill sockets, lampguards, switches and other electrical specialties, write for catalog 84.

McGILL®
ELECTRICAL SPECIALTIES

are always a little better and ***ALL*** *are Underwriters Laboratories Inspected*

McGILL MANUFACTURING COMPANY, INC. **450 N. Campbell St., Valparaiso, Indiana**

When the foreman, superintendent, or electrical contractor are not informed of these changes or extra work before they take place, the extras are sometimes forgotten, and therefore not included in the final bill. Besides, it is a well known fact that on contract jobs where many changes occur, it is often very difficult for the contractor to receive full payment for all his work without a great deal of trouble. Also, there are times that the person making the request for a change does not realize that this will cost an additional sum over and above the contract price. When the time comes to make final settlement, he either has no recollection of the changes made, or does not want to pay for them, because he did not consider them an extra.

Herb Binner, executive secretary, of the Cook County Electrical Contractors Association, aware that this type of thing was happening to members of his organization, devised a Change Order Form.

The forms are headlined with a write-in space for the electrical contractor's name and the date. Following this is a short paragraph which states: "We have authorized your electrician to furnish additional material and labor as described below. It is understood that such extras or changes are not included in the original contract presently in force." A brief description of the work is then listed in the space provided, after which the owner, architect, or general contractor who requested the change signs his name, which is cosigned by the electrician. Triplicates are printed in pad form, one copy going to the person requesting the change or extra work, while the two duplicates are turned into the office, to be filed with the original contract.

With these forms in use, it is easy to record orders for changes or extra work on the spot, eliminating any long complicated forms, telephone calls or inconveniences to the workman or person requesting the change. Later on, when the job is completed and all extra bills are sent out it is a simple matter to send along a signed copy of the Change Order Form.

ORDER FOR CHANGES OR EXTRAS

To _____ Electl Cont

Date _____

We have authorized your Electrician to furnish additional material and labor as described below It is understood that such extras or changes are not included in the original contract presently in force

This is a mimeographed copy of the proposed printed form

Signed _____
Owner - Architect - General

By _____

Signed _____ Electrician

(one copy to owner - two copies to office)

Silver Busbars At Oak Ridge

MATERIAL

Not many persons know that for a long time Oak Ridge, Tenn. was, for a fact, a branch repository of silver for the Government. Actually at the peak of atomic production some 15,000 tons with a value of $500,000,000 was in service in one production plant alone—the electromagnetic production works oper-

SILVER BUSBARS, formerly used in the electromagnetic process for atomic energy production at Oak Ridge, Tenn., were recently returned to the U. S. Treasury Department. Silver bars were cleaned, rolled free of kinks and cut into short lengths for easy transit.

Getting Up Fast

Keeps Labor Costs Down

Set up the Baker Scaffold in 90 seconds or less and you're ready to move from room to room, over desks and other room equipment which normally presents a problem for scaffolds with cross braces. Its light weight permits one-man portability on your choice of large rubber-tired casters. Combines with companion units to form higher or wider platforms. Locks into rigid position. Has the substantial feel of steel that only steel can give.

BAKER SCAFFOLDS

DESIGNED FOR PORTABILITY—BUILT FOR DURABILITY

Free Scaffold Literature describes fully the features of the Baker Scaffold.

BAKER-ROOS, INC.
P. O. Box 892, Indianapolis 6, Indiana

Gentlemen: Send the folder described on Baker Scaffolds without obligation ECM

Name _____

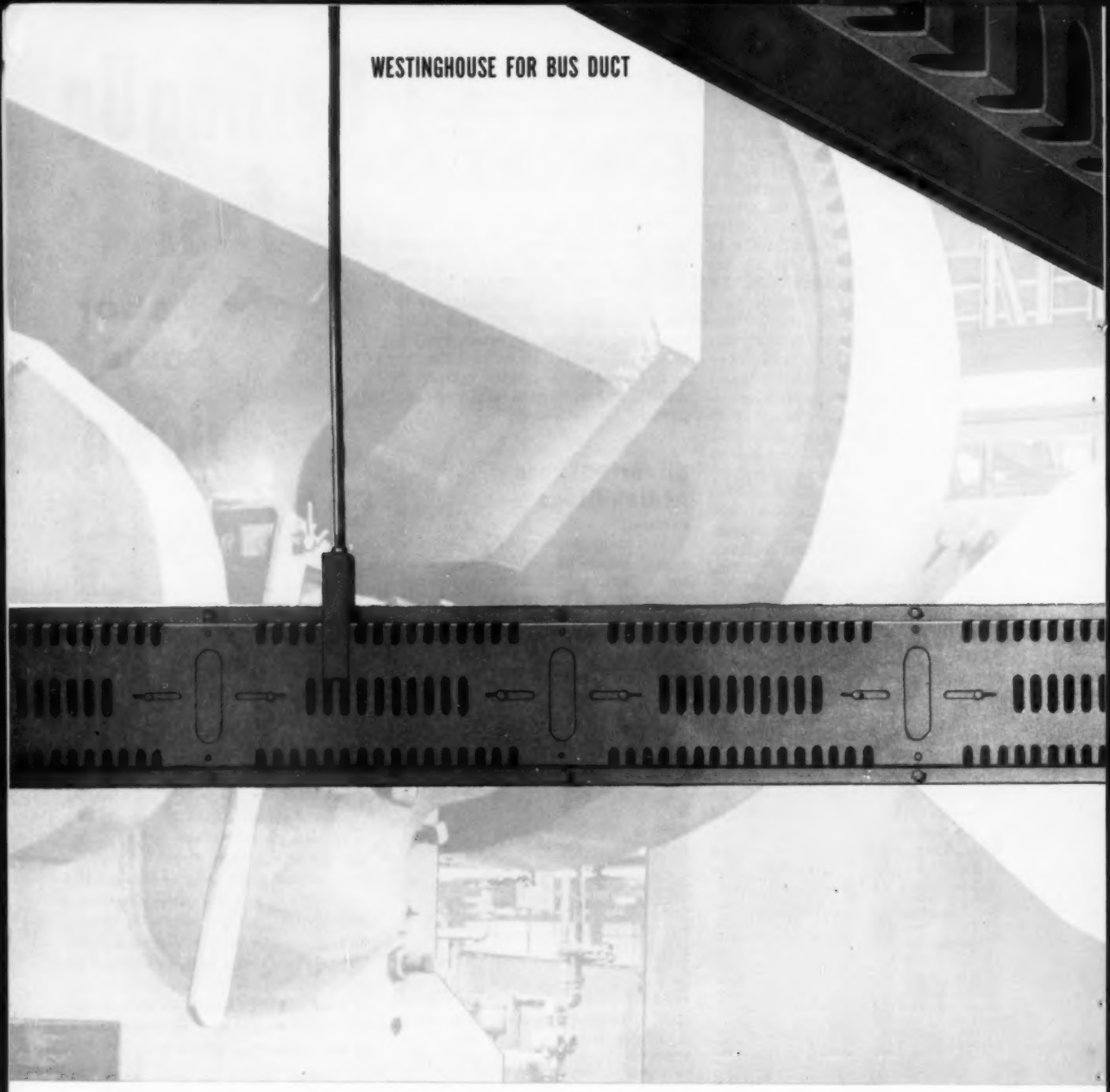
Organization _____

Address _____

City _____ State _____

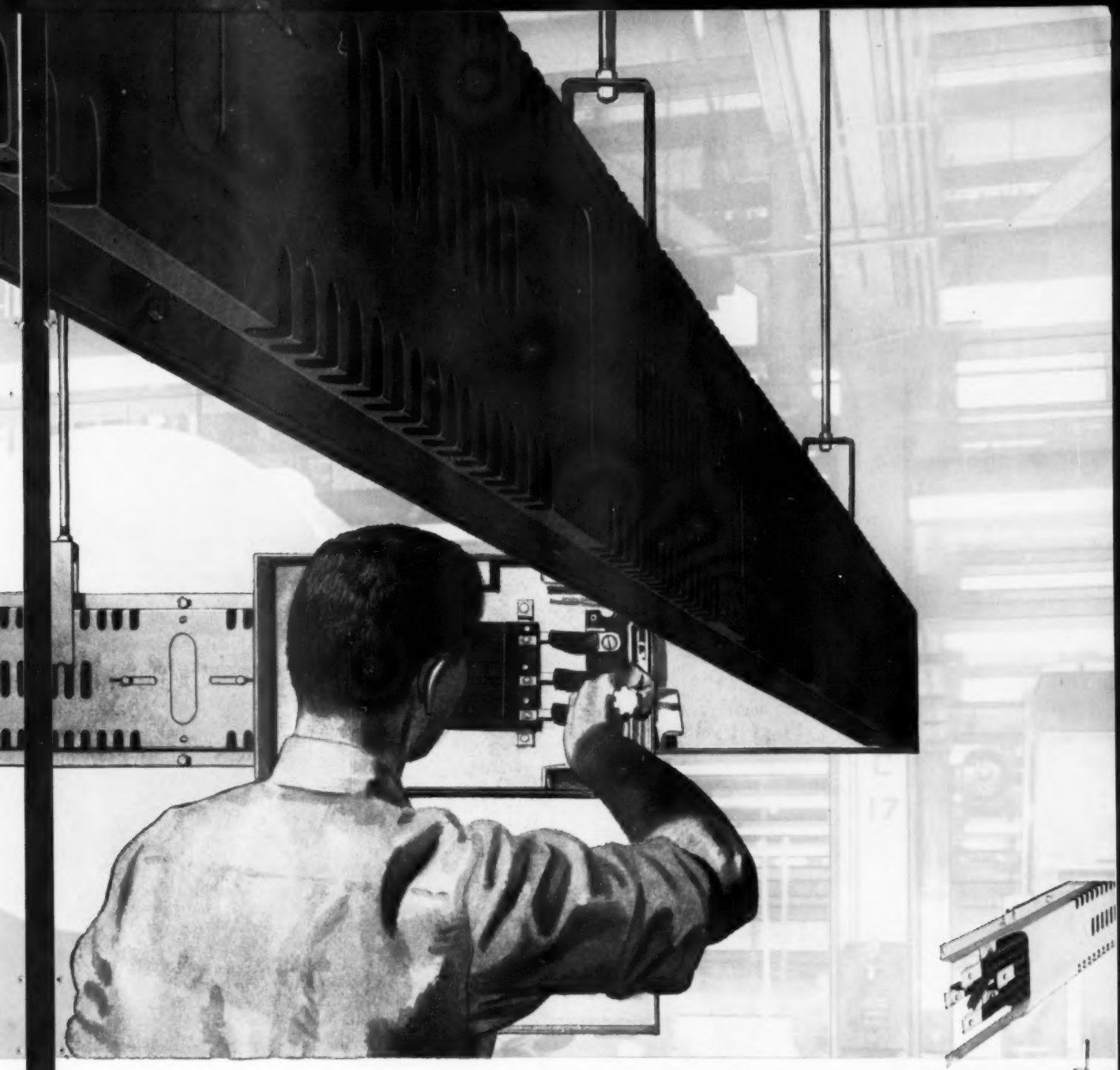
DISTRIBUTORS IN PRINCIPAL CITIES

WESTINGHOUSE FOR BUS DUCT



Safest busway you

Westinghouse Life-Line bus duct gives workers and management EXTRA protection



can buy!

The most efficient bus duct in the world is no bargain if it's not absolutely safe. But . . . here's a busway that's both highly efficient *and* safe. Westinghouse Life-Line® bus duct!

Westinghouse Life-Line bus duct combines cost-saving low impedance characteristics with plug-in convenience—and gives you an all-important extra dividend—a foolproof interlocking safety slide that eliminates exposed live parts.

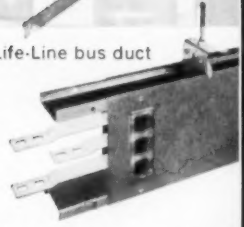
There's not a chance of touching a hot part, even when installing plug-in devices. *Every* part of the plug-in device is electrically dead, even after it's been mounted on the duct—until the cover has been closed, the contact handle turned to ON.

Of course, Westinghouse Life-Line bus duct has all the features that *make* bus duct so desirable: light weight; quick and easy installation; flexibility to accommodate growing power demands—and—*important cost savings* on many jobs.

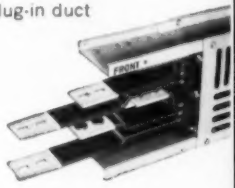
For more detailed information, contact your nearby Westinghouse sales office or write: Westinghouse Electric Corp., Standard Control Division, Beaver, Pennsylvania.

J-30287

Life-Line bus duct



Plug-in duct



Low Impedance duct

YOU CAN BE SURE...IF IT'S Westinghouse

Why Is RIDGID The World's Most Popular Pipe Wrench

...because it was a better pipe wrench when first created 35 years ago, and nearly every year since it has been improved . . . in performance, design, materials, so it is still the most for your money. Buy RIDGID at your Supply House.

The Ridge Tool Company, Elyria, Ohio, U.S.A.

ated for the Army by the Tennessee Eastman Corporation, an affiliate of the Eastman Kodak Co. of Rochester, N. Y.

Electrical construction men will remember with clarity the difficult time they had procuring copper in large lots for the fabrication of busbars. The Army found itself in the same boat when the Stone-Webster Company of Boston and its sub-contractor, the Watson-Flagg Co. of New York, were assigned the giant task of building the U-235 separation works at the Y-12 location, one of the three atomic plants in Oak Ridge.

The Army, operating under the cognomen of the Manhattan Project directed by General Groves, had an advantage denied mere civilians: it could and did commandeer the silver it needed from the Treasury where it was in idle storage being held as collateral for the paper bills in circulation. Well wrapped in Kraft paper, it arrived under armed guard in a small freight train shipment for storage in war emergency shops, where it was fabricated into the desired shapes and lengths for erection in the massive busbar installation needed to convey the heavy amperage in direct current for the "tracks" or giant ovals of magnets.

The magnets too required silver for the fabrication of the coils, hence much of it was shipped to the plants of the Allis-Chalmers Co. in Milwaukee, Wis. As one might expect, all the people working with the silver had been screened by J. Edgar Hoover's men. And strict accountability was maintained for every ounce of the soft, shiny white metal by all persons concerned. Each of the 3000 odd pieces was stamped to identify it, and the plans showed where each piece was located in the vast network of magnet coils set on each side of a channel in which the ionized gases whirled by high-voltage dc kicks.

With the dropping of the bombs that ended the Japanese War, the electromagnetic process was abandoned for all practical purposes, since it proved too expensive. Only a small portion remained in operation to produce the peace time isotopes, and other equipment was converted to cyclotron use for the production of isotopes not possible by the old calutron method. About 1949 some buildings were stripped bare for installation of new research programs and the silver was then removed for final return to its original owner, the United States Treasury.

Assure safe, "worry-free" splices by using tapes that are cable compounds . . .

In a safe, "worry-free" splice, the wall of electrical insulation around the connector is built up with a tape made with a cable insulation compound. The sheath, an extension of the cable's protective covering, is composed of a weather-, chemical- and abuse-resistant tape made with a cable sheathing compound. In other words, the splice . . . far from being a weak link in the cable . . . can be every bit as reliable.

Okonite splicing tapes are true cable compounds. The same ingredients are used in both. For example, Okolite Tape is made of the same basic compound as Okolite high voltage cable insulation. Okoprene Tape corresponds to the service-proved Okoprene cable sheath. Both of these materials—Okolite and Okoprene—have been specified by leading industrials for over 20 years.

Free samples of the Okonite Tapes are yours for the asking. Write to "Tape Dept., The Okonite Co., Passaic, N. J." and you'll promptly receive a trial kit containing a roll of Manson Friction Tape, Okonite Low Voltage Insulating Tape, Okolite High Voltage Insulating Tape, and Okoprene Sheathing Tape.

YOUR COMMUNITY'S LEADING ELECTRICAL WHOLESALER IS THE AUTHORIZED DISTRIBUTOR OF OKONITE QUALITY TAPES.

where there's electrical power . . . there's **OKONITE CABLE**

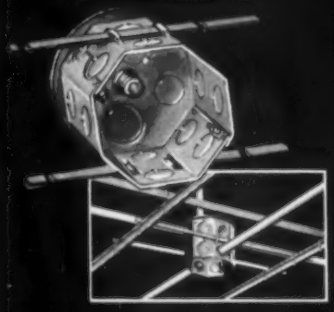
5607

NEW DESIGN!

Arrow Conduit's

HUNG CEILING BOX

— for Dropped Ceiling Construction



— with these top features:

- New extruded slots for supporting bars.
- Easy to set in exact channel position.
- Avoids costly pipe bending.
- No extension collars needed.
- All 16 knock-outs can be used.

Feature by feature, this is the most versatile hung ceiling box available . . . and the easiest to install.

Write for new catalog sheet.

Skill & Experience . . .
—active ingredients in all Arrow products.

ARROW CONDUIT & FITTINGS CORP

OUTLET BOXES • GANG BOXES • COVERS • BOX SUPPORTS

ARROW CONDUIT & FITTINGS CORP.
129 30th Street, Brooklyn 32, N.Y.

Sales Representatives & Warehouse Stocks*
BALTIMORE, MD. • *CHICAGO, ILL. • *CINCINNATI, OHIO • DALLAS, TEX. • GREENSBORO, N.C. • *KANSAS CITY, MO • *LOS ANGELES, CALIF. • *MIAMI, FLA. • NEW YORK, N. Y. • NEWTON CENTRE, MASS. • *PHILADELPHIA, PA. • ROCHESTER, N. Y. • *TAMPA, FLA.

COVES, in ceiling, above wall mural and beneath bar-top, custom-made luminaires, on bar counter and wall tables, and recessed downlights in random spacing pattern are used as decorative tools in this attractively-designed ladies' bar in the Milwaukee Athletic Club.

Cocktail Lounge Reveals Lighting Variety

ILLUMINATION

Wives and dates of Milwaukee Athletic Club members can mix pleasant refreshments with their girl-talk in the relaxing environment of an attractively decorated and illuminated Cherry Blossom Room where soft colors and lighting combine to create an atmosphere of friendly charm. Paneled in natural wood, with delicate Japanese prints and murals, this room is further feminized through the medium of pink-and-turquoise figured carpeting, a pink-white central ceiling cove, deluxe warm-white top-lighting above the large mural, custom-made candelabra fixtures on the service bar and portable drum-shaded 25-watt IF lamps on wall-adjacent cocktail tables. Pinpoint R30 downlights in a random pattern lend additional interest to the lighting plan, while lumiline lamps, positioned beneath the lip of the projecting bar-top and shielded by pebbled plastic diffusing cover plates, cast a blanket of light downward to illuminate the upholstered bar-front and floor area.

Lighting load in this 18- by 38-ft room is in the order of 3½-kw; including the lighting mediums just enumerated plus a 4-tube (white, green, pink and red) installation around the periphery of the ceiling cove, and two 75-watt R30 uplights contained in the bases of the two bar-top candelabras. The bare lamps are 6-watt clear bulbs.

Connectors for Liquid-Tight Flex

WIRING

Electrical codes call for liquid-tight connectors properly insulated, gasketed and grounded for terminating liquid-tight flexible metal conduit at cabinets, junction boxes and pull boxes. Standard connectors, which do not have adequate threads to accommodate a gasket assembly, box wall thickness, a locknut and an insulated bushing, would have required additional installation time and labor and taken space in the boxes needed for conductors.

Equipment involved were heavy presses at the *Miami News*, Fla. Press operation would cause severe vibration along raceways, shaking conductors and making insulating bushing protection for conductor insulation especially necessary to avoid continued trouble due to short circuits and grounds.

Use of liquid-tight connectors with integral insulated throats, a combination fitting recently designed by The Thomas & Betts Co., filled code requirements and eliminated the installation and space problems. The built-in insulation saved on the extra time and effort spent to handle and install separate bushings which standard liquid-tight connectors require to accomplish the same protection.

Space was at a premium in the boxes because each was crowded with many small control cables. The separate bushings of the stand-

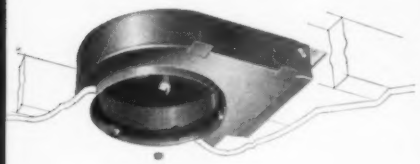
2

great names combine

EMERSON pryne

to bring you the world's best in...

SPOT VENTILATION



ONLY *Blo-Fan* EXHAUST VENTILATORS ARE SO EFFICIENT

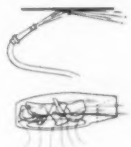
Blo-Fan *means power of a* **BLO***wer plus volume of a* **FAN**

The exclusive, patented Blo-Fan blade has been especially engineered to combine the best features of a "squirrel cage" BLOwer and the best features of a propeller FAN.

Blo-Fan housings are only 3¼" thick to allow installation behind the plaster on standard 2"x 4" studs. Pre-wired built-in splice box permits easy electrical connection. 3¼" x 10" duct is used to carry exhaust air to the desired external fitting.

Made in five models to fit every application, the Blo-Fan scoops up air in great volume and forcibly exhausts it with all the power of a blower to achieve greater performance efficiency than any comparable fan. All models have built-in automatic damper to prevent back-drafts. Attractive die cast grilles are made of rust-proof genuine polished chrome.

ORDINARY "PROPELLER" ACTION



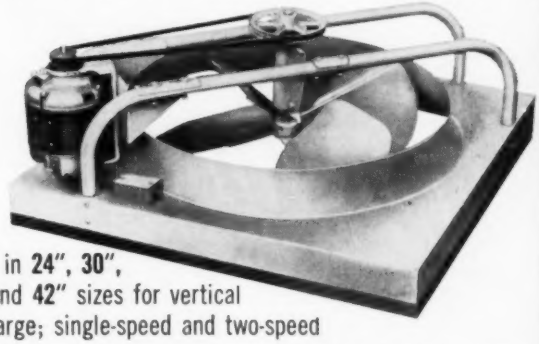
BLO-FAN "BLOWER" ACTION

Forced air, like water, must be directed to prevent "back wash"... and only the Emerson-Pryne Blo-Fan operates with full efficiency.

COMPLETE HOME COOLING

Now give your customers "AIR COOLED" homes with EMERSON-PRYNE...

ATTIC EXHAUST FANS



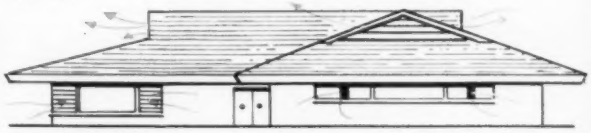
Made in **24"**, **30"**, **36"** and **42"** sizes for vertical discharge; single-speed and two-speed

Emerson-Pryne attic fans with their quiet vibration-free operation, certified air deliveries, ball-bearing construction and 5-year guarantee are priced to meet the budget requirements of project builders.

Home buyers prefer Emerson-Pryne attic fans, because these nationally-known, ruggedly built fans give many years of maintenance-free summer comfort at low operating cost.

Built-in lifetime lubrication—ball bearings on fan shaft and motor require no relubrication.

Simple installation—rubber channels on bottom edge of fan frame rest on wood framing above ceiling opening. No plenum chamber (suction box) required.



Emerson-Pryne attic fans provide the ideal answer to low cost home cooling. Properly installed a single attic fan can assure rapid and complete home cooling—or individual room air change can be easily controlled simply by closing doors and windows.

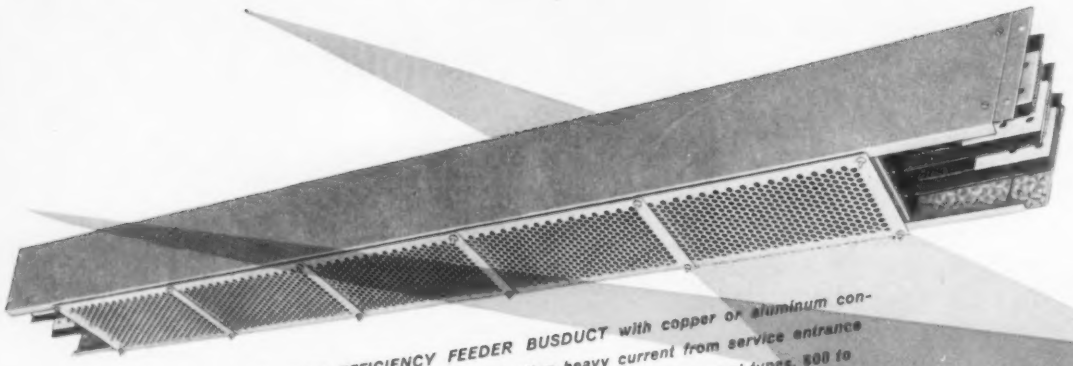
Low initial cost plus fast, easy installation makes it possible for you to offer home owners this sales-winning convenience feature at prices well within your building budget.

World's leader in EXHAUST FANS · EXHAUST BLOWERS · ATTIC FANS · AIR CIRCULATORS
KITCHEN HOODS · CEILING HEATERS · RECESSED LIGHTING FIXTURES

EMERSON pryne COMPANY

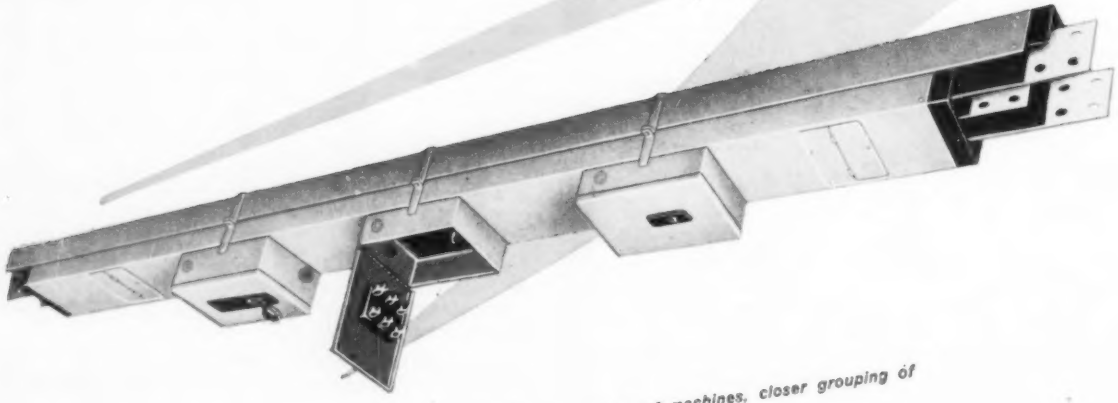
POMONA, CALIF. · KEYSER, W. VA.
ST. LOUIS, MO. · TORONTO, CANADA

A DIVISION OF THE EMERSON ELECTRIC MFG. CO., ST. LOUIS, MO.



HIGH EFFICIENCY FEEDER BUSDUCT with copper or aluminum conductors is unsurpassed for conducting heavy current from service entrance to point of use. Furnished in 2, 3 and 4 conductor solid neutral types, 500 to 4000 amperes.

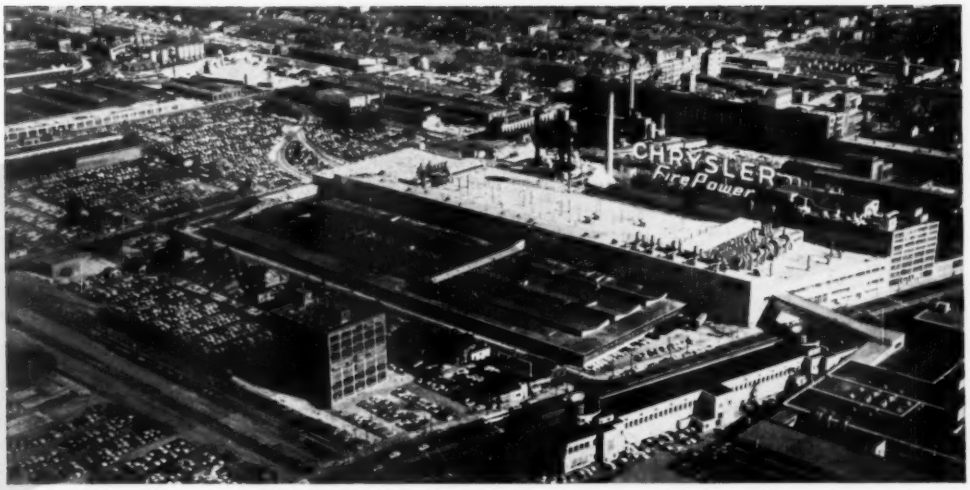
Frank Adam Busduct PROVIDES PRODUCTION POWER at the Chrysler Division plant



Powerplugin is ideal for connections of machines, closer grouping of equipment, etc. Provides plugin outlet every foot of the way.

Capacities 250 to 1500 amps, 600 volts AC or less, with fuseable or Circuit breaker plugin devices 2, 3 and 4 wire conductor, solid neutral types.

Airview of the Chrysler Division Plant, Chrysler Corporation in Detroit



The Chrysler Division Plant, Chrysler Corporation in Detroit, is another of America's largest industries in which Frank Adam Busduct—the modern system of power distribution—is playing a vital role.

By making power available where and when it is needed—just plug in and go—Frank Adam Busduct is helping scores of companies—large and small—in all sections of the country, to speed production, increase plant efficiency and lower operating costs.

Approved by the Underwriters' Laboratories, Inc., for label service, Frank Adam Busduct permits quick changes in plant and structural layout without disrupting production, eliminates temporary connections and long lead-ins, cuts maintenance costs and affords other savings by reducing power loss caused by voltage drop to a minimum. Too, it is 100 per cent salvageable.

If you want to increase plant efficiency, speed production and lower operating costs, Frank Adam Busduct—the modern system of power distribution—is your answer. Contact your nearest FA representative listed in Sweets or your FA wholesaler for information on how you can utilize Frank Adam Busduct in your business.

FRANK ADAM

FA

FRANK ADAM ELECTRIC COMPANY

BOX 357, MAIN P. O. • ST. LOUIS 3, MO.

makers of

busduct • panelboards • switchboards • service equipment

safety switches • load centers • Quikheter

TESTED BY TIME

APPROVED BY EXPERIENCE

BORTHIG K-252
Baking Varnish

for MOTOR and TRANSFORMER WINDINGS

For 10 years K-252 has been proving itself an excellent and reliable Baking Varnish for Class B operations.

Because of its overall economy and proven satisfactory performance, Borthig K-252 Insulating Varnish will fit perfectly into your Class B insulating systems. Give your motors, transformers, form and random wound coils and armatures the full lifetime protection that Borthig K-252 affords. Give them the benefits of K-252's excellent penetrating and good bonding qualities—and of its high wet and dry dielectric strength.

An extra plus of K-252 is that it is entirely compatible with the modern Class B sheet and tape insulations.

Look to Borthig to furnish all your baking and insulating varnish and compound needs with products that are time-tested and proven by experience:

- **Epoxy Compounds**
- **Epoxy Thixotropic Pastes**
- **Stator Compounds**
- **Air Drying Varnishes**
- **Epoxy Varnishes**
- **Fungicidal Varnishes**

GEORGE C. BORTHIG COMPANY, INC.

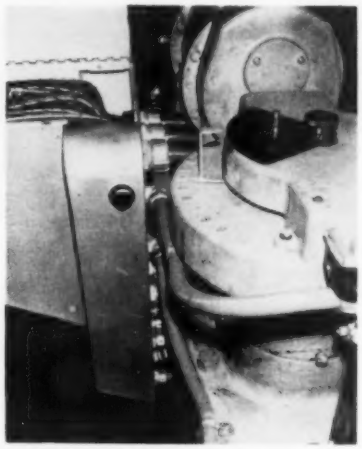
TRADE B MARK *Insulating Varnishes*

East Rutherford 6, New Jersey Drawer 115

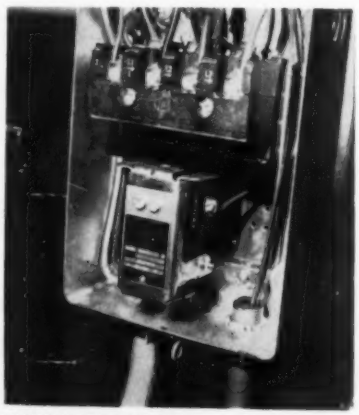
ard fittings would have taken space all around the connector, overlapping in some cases on other knockouts of the box. The built-in bushing, lining the throat and edges of the connector, occupied no space in the boxes.

The liquid-tight connector with the built-in insulated throat includes a steel grounding cone and a Zytel sealing gland, exactly like uninsulated liquid-tight flexible conduit connectors. Besides sealing tightly, the Zytel gland also protects the raceway's plastic jacket.

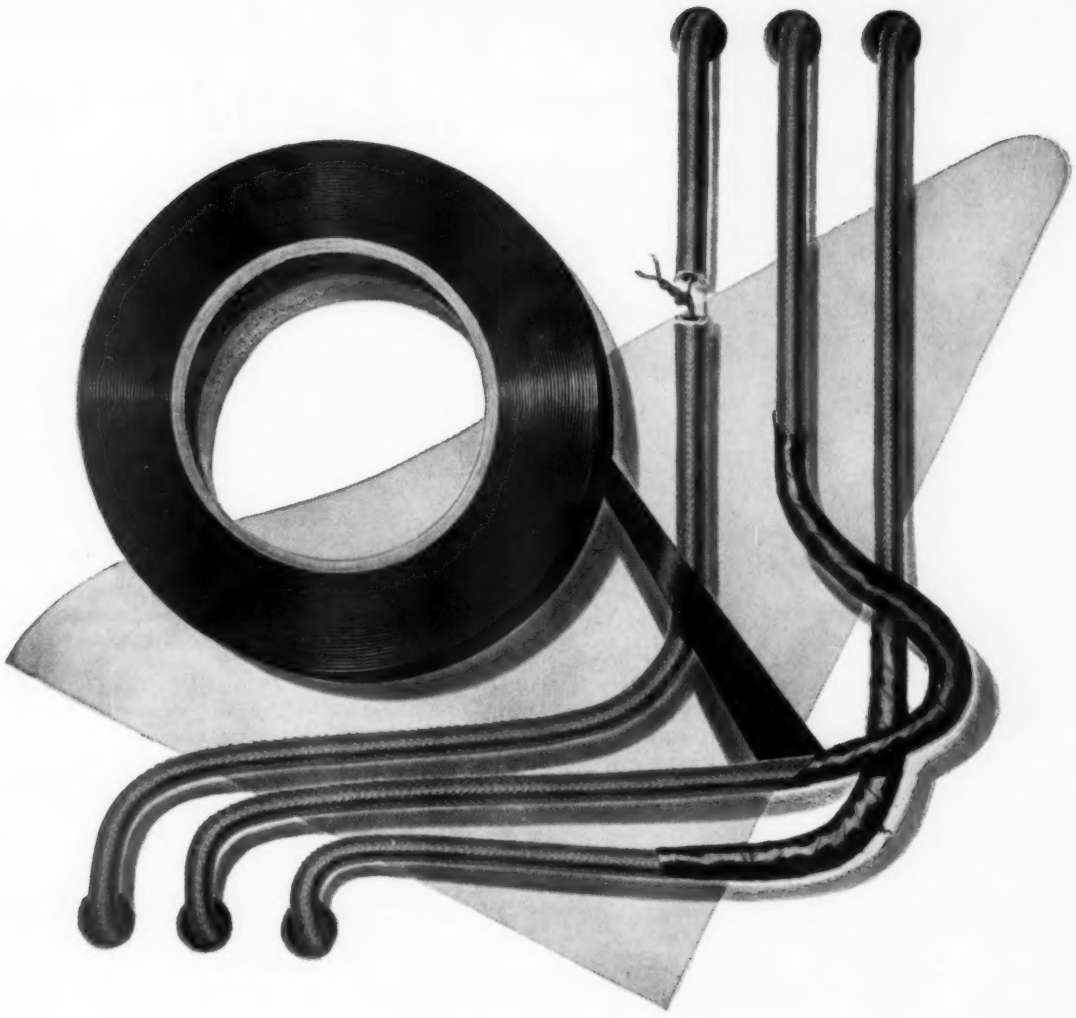
Cornelius Electric Company of Miami, electrical contractor for the new plant, noted that the smooth insulated throat also facilitated wire pulling.



LIQUID-TIGHT FLEX snakes through tension switches into control terminal cabinet. Insulated throats of liquid-tight connectors provide built-in protection for conductor insulation at terminal points where vibration of nearby equipment causes rubbing between conductors and conduit wall.



INSULATED THROAT is built into liquid-tight connector shown in the bottom right hand corner of the box. A separate insulated bushing would have occupied space up to about the knockout to the left of the connector.



whatever the job . . .

PERMACEL®

PLASTIC ELECTRICAL TAPES

Another product of PERMACEL-LEPAGE'S INC. *New Brunswick, N.J.*

a Johnson-Johnson company

Tapes • Adhesives • Electronic and Chemical Materials

KLEIN

THE THRILL THAT ONLY GOOD TOOLS CAN GIVE

"Since 1857"

It's a pleasure to use good tools —pliers that grip tight . . . that cut through tough wire easily . . . that reach confined spaces.

Linemen and electricians know that they can rely on their Kleins—side cutters, long nose, oblique cutters—famous for quality for a century.

There is a Klein Plier exactly suited to every electrical need—carried in stock by better electrical suppliers everywhere.

100 years of service to linemen, electricians and industry is back of this new Pocket Tool Guide No. 100. A copy will be sent you on request, without obligation.

Mathias Established 1857 KLEIN & Sons Chicago, Ill., U.S.A.

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Management

Compare Your Operating Ratios

Important business operating ratios compiled by Dun & Bradstreet, Inc., show current median, upper quartile and lower quartile values from a sampling of electrical contracting businesses.

TO COMPARE the soundness of their business operations, many business men have used a set of significant ratios compiled since 1931 by Roy A. Foulke, vice president of Dun & Bradstreet, Inc. Fourteen important ratios are reported for 72 lines of business of which ten are applicable to electrical contracting.

The data used are based upon a sampling of business enterprises with a tangible net worth which only occasionally is below $75,000. The center figure for each of the lines of business is the median. The other two figures are quartiles; for each ratio they indicate the upper and lower limits of the experiences of that half of the concerns whose ratios are nearest to the median. When any figures are listed in order according to their size, the median is the middle figure (same number of items from the top and the bottom) and the quartiles are the figures that are located one-quarter and three-quarters down the list.

Terms are defined as follows:

CURRENT ASSETS: Total of cash, accounts and notes receivable for the sale of merchandise in regular trade quarters less any reserves for bad debts, advances on merchandise, inventory less any reserves, listed securities when not in excess of market, state and municipal bonds not in excess of market, and United States Government securities.

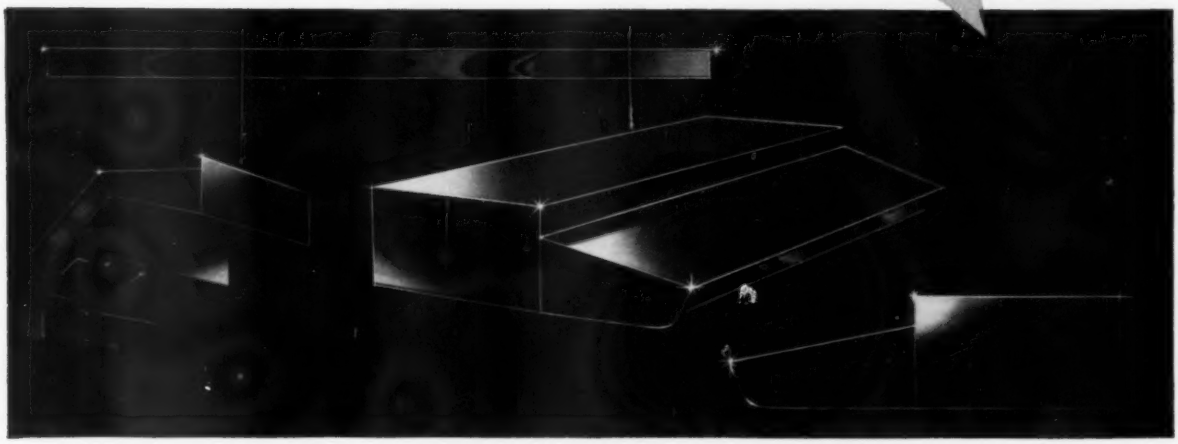
CURRENT DEBT: Total of all liabilities due within one year from statement date including current payments on serial notes, mortgages, debentures or other funded debts. This item also includes current reserves such as gross reserves for Federal income and excess profits taxes, reserves for contingencies set up for specific purposes, but does not include reserves for depreciation.

FIXED ASSETS: The sum of the cost value of land and the depreciated book values of buildings, leasehold improvements, fixtures, furniture, machinery, tools, and equipment.

FUNDED DEBT: Mortgages, bonds, debentures, gold notes, serial notes or other obligations

Electrical Contractors	Upper Quartile	Median	Lower Quartile
Current Assets to Current Debt (times)	3.75	2.48	1.81
Net Profits on Net Sales (per cent)	4.58	2.07	.83
Net Profits on Tangible Net Worth (per cent)	19.46	9.63	2.70
Net Profits on Net Working Capital (per cent)	27.03	13.80	3.63
Net Sales to Tangible Net Worth (times)	5.72	4.37	3.24
Net Sales to Net Working Capital (times)	8.23	5.36	4.21
Fixed Assets to Tangible Net Worth (per cent)	7.7	16.2	24.4
Current Debt To Tangible Net Worth (per cent)	33.0	58.1	92.6
Total Debt to Tangible Net Worth (per cent)	59.7	77.3	102.1
Funded Debts to Net Working Capital (per cent)	7.7	23.6	44.4

BE MODERN...GET THE Slim Trim LOOK OF POWER RANGE HOODS BY FASCO



Here's the power range hood with crisp, new styling that blends with today's trend to modern, efficient kitchens. And only Fasco has it!

Featuring built-in light, easy-to-clean filter, and quiet, powerful turbo-impeller, this new Fasco power range hood is the perfect finishing touch for any kitchen.

Give the kitchen you build the extra sparkle that lifts it out of the ordinary... install a Fasco power range hood and see how it pays off in sales.

BE MODERN...TAKE A fresh LOOK AT VENTILATORS BY FASCO

You will find it pays in more ways than one to take another look at Fasco. You'll see a complete line of ventilators all with smart "no-rust" anodized aluminum grilles. You'll see ventilators that cut installation costs ... the trimmest ventilator on the market ... and a host of other features in this value-packed line designed and priced to reduce your costs.

Take a fresh look at all the new Fasco features... they will convince you Fasco ventilators are your best buy today.

Please send me full information on new hoods and ventilators.

EC & M—258

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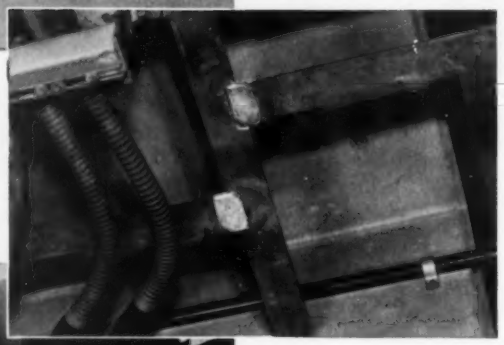
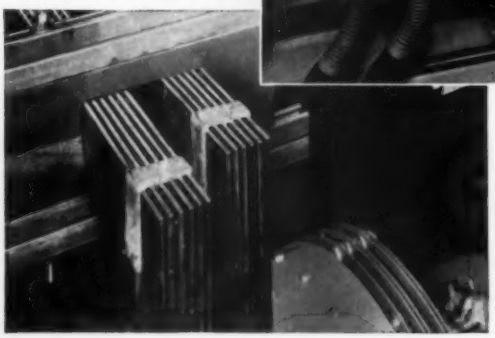
FASCO
INDUSTRIES, INC.
ROCHESTER 2, N. Y.

BUS CONNECTIONS BEST with CADWELD®

Cable Taps to Bus Bar

Bus Bar Taps to Bus Bar





Multiple Bus Bar Connections

When making electrical connections to bus bar, CADWELD is best. 100% electrical current carrying capacity of the conductors is obtained every time. Plus every connection is permanent, there is no loosening or corrosion.

90% of the possible connections are standard and the remaining 10% (specials) can be handled in record time.

The finished CADWELD connection is more compact than any mechanical connection on the market.

CADWELD Electrical Connections have attained their high rating from Engineers and Contractors for their reliability. There is no maintenance on a CADWELD Connection.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

MANAGEMENT (CONTINUED)

with a maturity of more than one year from the statement date.

NET PROFITS: profit after full depreciation on buildings, machinery, equipment, furniture, and other assets of a fixed nature; after reserves for Federal income and excess profits taxes; after reduction in the value of inventory to cost or market, whichever is lower; after chargeoffs for bad debts; after miscellaneous reserves and adjustments; but before dividends or withdrawals.

NET SALES: The dollar volume of business transacted for 365 days net after deductions for returns, allowances, and discounts from gross sales.

NET SALES TO INVENTORY: The quotient obtained by dividing the annual net sales by the statement inventory. This quotient does not represent the actual physical turnover which would be determined by reducing the annual net sales to the cost of goods sold, and then dividing the resulting figure by the statement inventory.

NET WORKING CAPITAL: The excess of the current assets over the current debt.

TANGIBLE NET WORTH: The sum of all outstanding preferred or preference stocks (if any) and outstanding common stocks, surplus, and undivided profits, less any intangible items in the assets, such as good-will, trademarks, patents, copyrights, leaseholds, mailing lists, treasury stock, organization expenses, and underwriting discounts and expenses.

TURNOVER OF TANGIBLE NET WORTH: The quotient obtained by dividing annual net sales by tangible net worth.

TURNOVER OF NET WORKING CAPITAL: The quotient obtained by dividing annual net sales by net working capital.

LIVE BETTER ELECTRICALLY

Black & Decker Tools for maintenance ... electric power at its saving best!

No. 65 VACUUM CLEANER: handles wet or dry material. Big 1¼ hp motor for plenty of suction. Super-flexible hose stretches to a full 15 ft.

6" H.D. BENCH GRINDER: Ruggedly built for H.D. grinding, sharpening, wire brushing or buffing. Full ½ hp constant speed motor keeps jobs moving.

No. 10 SCRUGUN®: Driving screws goes faster; handles up to No. 12 screws. Positive or adjustable clutch; center drive, end handle or pistol grip.

1⅛" HAMMER: 2200 punching blows a minute makes drilling, chipping, breaking or vibrating go faster, easier. Saves maintenance costs!

Specify the POWER-Built line:

71% of buyers say B&D!

Whether it's a grinder or a cleaner; a drill or a power hammer—over 7 out of 10 industrial purchasers prefer Black & Decker! Experience has told them Black & Decker means *quality*; quality they can depend on to give them years of trouble-free service.

If you have an electric tool need—one illustrated here or any other—do as most people do: think *first* of Black & Decker. That's the name that means a tool to *do the job* and do it for years and years to come. Mail coupon for a free demonstration of the tool you need. THE BLACK & DECKER MFG. CO., Dept. 1202, Towson 4, Md. (In Canada: P.O. Box 278, Brockville, Ontario.)

Look Under "TOOLS-ELECTRIC" in Yellow Pages

Leading Distributors Everywhere Sell

Black & Decker®

Quality Electric Tools . . . Power-Built for top performance

MAIL FOR FREE DEMONSTRATION

THE BLACK & DECKER MFG. CO., Dept. 1202, Towson 4, Md.

Please arrange a demonstration of your ☐ No. 65 Vacuum Cleaner; ☐ 6" Bench Grinder; ☐ No. 10 Scrugun; ☐ 1⅛" Hammer.

☐ Send me additional information.

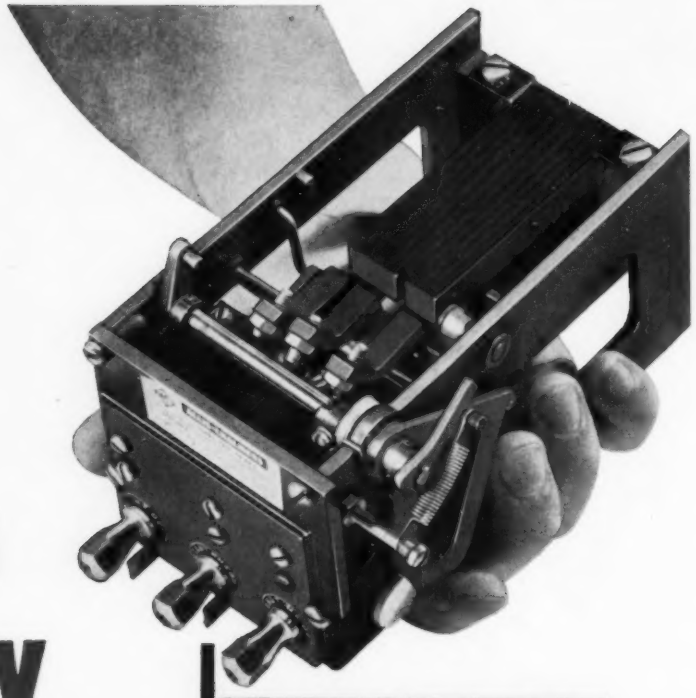
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

ALLIS-CHALMERS
low voltage
switchgear



Here's

Proven Accuracy

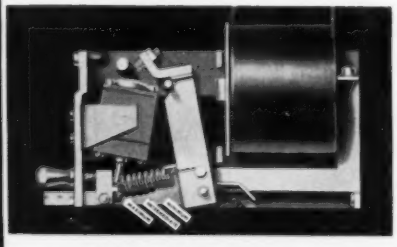
3 independent elements available in series trip device

This time-proven feature of Allis-Chalmers low voltage switchgear provides:

- **Accurate settings** — Adjusting knobs with calibration scales on front of trip device permit operator to adjust elements independently and set pickup for long time (80-160%), short time (500-1000%), and instantaneous (500-1500%).
- **Accurate action** — Silicone oil-filled, positive displacement time-delay device is completely calibrated and sealed under vacuum.
- **Accurate adjustment** — Minimum, maximum and intermediate time-delay band settings are field adjustable for each pickup value for fine selectivity.
- **Accurate indication** — Overcurrent trip flag to indicate phase which caused tripping of breaker is available.

Each trip element has its own armature and each armature acts directly on trip block. Accurate trip device is only one feature of Allis-Chalmers low voltage switchgear. For complete details, call an A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Operator inserting circuit breaker using positive-position pantograph. Note trip device accessibility, dead-front breaker, and drawout interlock.



Cutaway shows arrangement of components in Allis-Chalmers direct-acting series trip device. Note calibration scale below adjusting knobs and time band setting on armature extension.

A-5553

ALLIS-CHALMERS

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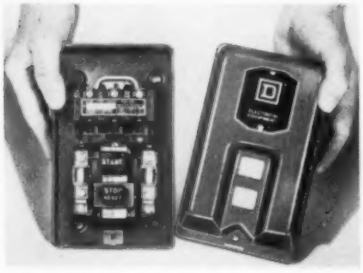
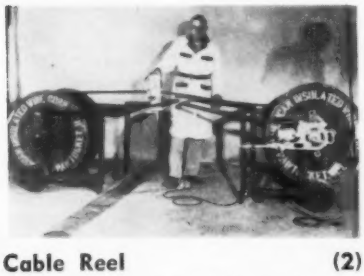
Product News



Manual Starter (1)

A new line of Class 2510 integral hp manual starters, in NEMA Size 0 and 1, for control of motors up to 7½ hp. New design features a heavy-duty, toggle action operating mechanism which gives positive snap-action opening and closing of contacts, with no dead center position. Trip-free overload protection is provided by melting alloy type relays of Square D unit construction. Self-centering pushbuttons give visual indication of an overload condition. Rated up to 600 volts ac or 250 volts dc, these starters are available in 2-, 3- or 4-pole construction. In addition to an open-type version, a complete line of newly styled enclosed models is offered to meet a wide range of application requirements. Pressure wire connectors are provided.

Square D Company, 4041 *North Richards St., Milwaukee* 12, *Wis.*



Cable Reel (2)

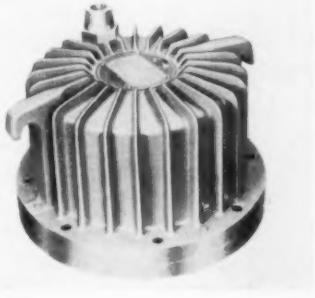
The new Kart-O-Matic equipment is ideal for rereeling cable from one reel to another. The power drive used on Kart-O-Matics can be used on the Marion Coiler Stand and also for pulling cable through conduits and threading pipe. Kit No. 1032 contains cart model 2032-A standard pick-up cart including pick-up shaft, three sets of reel bushings, and wire leveler; cart model 2032-B equipped with a drive shaft, three sets of reel bushings, wire leveler, locking device and power drive bracket; CVM meter and bracket, power drive unit with foot control switch. These carts will handle reels 32 in. wide weighing 2000 lbs. Kit No. 1042 is the same as kit No. 1032 except carts will handle reels up to 42 in. wide weighing up to 3000 lbs. Literature is available.

Weber Electric Mfg. Co., Inc., 15224 *Kercheval, Detroit* 30, *Mich.*

Circuit Identification (3)

An interlocked aluminum covering for power and control cables is now offered in a range of colors for circuit identification, using painted Loxarmor. The phosphate base coat and baked enamel finish combine to provide a colored coating that is adherent and hard. Loxarmor is fabricated using an aluminum strip that is pre-painted. Splices can be repainted using a primer and a fast drying lacquer as the finish coat.

Okonite Company, Passaic, N. J.



Motor (4)

A new immersible motor for submerged operation. The unit is designed for close-coupling to agitators or pumps in sewage sumps, chemicals, water and abrasive industrial oils. Motor and pump can be raised and lowered into position together by means of the motor's lifting lugs. Features include leak-tight construction, neoprene breathers, oil-filled at factory, waterproof cable connections, compact design and corrosion resistant parts. It is engineered for submerged pumping service, mixers, agitators and special applications. Available in ratings of ¾ to 40 hp, both single and polyphase. Bulletin No. 2300 is available.

Louis Allis Co., 427 *E. Stewart St., Milwaukee* 1, *Wis.*

Converter (5)

A first in the frequency converter field, a transistorized high-frequency power source for lighting systems, has been announced. Prototypes now in use, in pilot installations, measure 5 in. by 4 in. by 19½ in., weigh 11 pounds, and deliver up to 1.5 kw at 1500 cycles and 150 volts peak, and others have been built in ratings of 3 kva. These 1500-cycle power sources are static devices, and are designed for use with rapid-start fluorescent lamps, but can also be made for instant-start or preheat lamps. Ballasts for lamps in pilot installations weigh only a few ounces, and losses are reported at about one-fourth that for the best 60-cycle ballasts for same lamps. By design modification, this power source can deliver any fixed frequency over the entire audio range. Standard 3-phase power is first rectified, then converted by transistor circuits. Available about June 1958.

Westinghouse Electric Corporation, Box 2278, *Pittsburgh, Pa.*

Motor Control (6)

The new "Fincor" motor-control package includes an ac motor, allowing use of normal 3-phase, 60-cycle current without rectification. Package is furnished in 1/6, ¼, ⅓ and ½ hp sizes for operation on 220 volts. Motors are mounted on NEMA size 56 frames and can be interchanged. Complete package includes motor, frame, a built-in tachometer to sense motor speed and a magnetic-amplifier speed controller. Other features are—dc plugging for time-controlled braking; controlled acceleration; pushbutton for start-stop; overload protection; anti-hunt provision to hold speed stable at the specified setting.

Fidelity Instrument Corp., 1000 *E. Boundary Ave., York, Pa.*

midwest

CONCRETE TIGHT

CONNECTORS and COUPLINGS

FOR THINWALL CONDUIT

SET SCREW TYPE

COMPLETELY NEW DESIGN

Patent Pending

EMT sizes 1¼", 1½" & 2"

- Staked set screws
- Large (¼-20) set screws
- Hex head for easier tightening
- Deep slotted head for better screwdriver purchase
- Threaded hub 22% longer to accommodate insulating bushing
- Heavy gauge seamless steel body.

"SIDE-BY-SIDE" set screws provide contact points on two different center lines of the conduit—

- assures that *both* set screws hold positively
- no conduit distortion
- completely eliminates obstruction in raceway

- **Tangentical locking . . .**
- Set screws provide wedging action against conduit
- Threads score conduit for positive tightening
- Maximum width between set screws for tool clearance

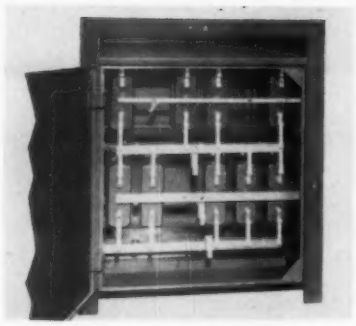
Here is another Midwest development in providing quality fittings. "Quality" is just a condensed way of saying: "Getting the total job done . . . right . . . with the most inexpensive combination of material and man-hours". Engineering and producing quality fittings to meet the highest standards of electrical wiring requirements, is our objective at Midwest.

Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET

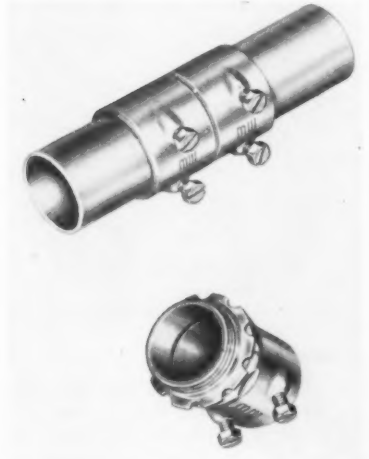
Chicago 12, Illinois



L-V Capacitor Equipment (7)

A newly designed Type LSO small low voltage capacitor equipment for outdoor industrial applications. Available in ratings from 60 to 180 kvars, 230 volts, and 80 to 240 kvars, 460 and 575 volts, 60 cycles, the equipment consists of individually fused capacitors assembled in a weatherproof housing. The 230-volt equipment uses 15 kvar units, while the 460- and 575-volt contain 20 kvar capacitors. Removable plate at base of equipment provides for incoming-line connections. Line terminals are clamp-type connectors. Pyranol liquid dielectric capacitor units are of welded-steel-case construction and have built-in discharge resistors. Cases are grounded to housing through mounting bolts. Grounded terminal is provided on outside of housing for connecting to system ground.

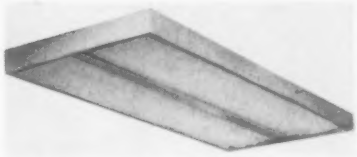
General Electric Company, Schenectady 5, N. Y.



Connectors (8)

New thin wall set screw connectors and couplings have been redesigned. They are for the larger EMT sizes, 1¼-in, 1½-in. and 2-in., and are concrete tight. The two set screws are positioned side by side to provide contact points on two different center lines of the conduit. The positioning of the set screws allows tightening through the same perpendicular plane; and allows maximum width between the set screws for tool clearance. On the connector, the threaded hub is 22% longer to accommodate insulating bushings. Body of fitting is heavy gauge, seamless steel.

Midwest Electric Mfg. Co., 1639 W. Walnut St., Chicago 12, Ill.



Lighting Unit (9)

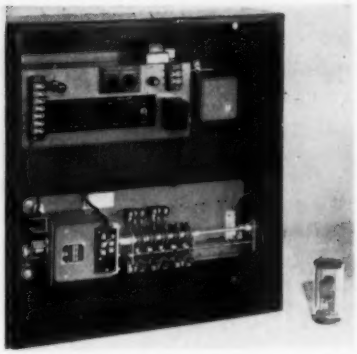
The new "Twin-Lux" luminaire is available in two styles: with 40° by 40° plastic louvers, style TXL; and with acrylic or vinyl diffusing panels, styles TXA and TXV. The louvered style can be provided with color filters for decorative lighting effects. Both styles have perforated metal trim between the panels. This shallow, two-by-four type fixture is for both new construction and modernization installations. Alignment is assured for both individual installations and end-to-end mounting. Fixtures are finished in all white Permalux over rust-inhibited metal. They carry UL labels.

Smoot-Holman Co., Inglewood, Calif.

Clamps (10)

New aluminum Type ADC U-bolt parallel clamps with specially designed wrap-around construction keeps the sides of the center spacer always in contact with the cap and bottom plate, forming a continuous wall of metal that completely encloses any size conductor within the clamp's range. Type ADC clamps are available with one, two or three aluminum alloy U-bolts, for a complete range of conductor sizes from No. 6 to 900 MCM, ACSR. Each size accommodates a range of aluminum ACSR or copper in either groove. Caps and bodies are of high strength aluminum connector alloys. Spacers are soft EC aluminum, conforming to conductor stranding, and are acid-alkali etched and grease-coated to provide an oxide free, clean metallic contact surface.

Penn-Union Electric Corp., Erie, Pa.



Lighting Control System (11)

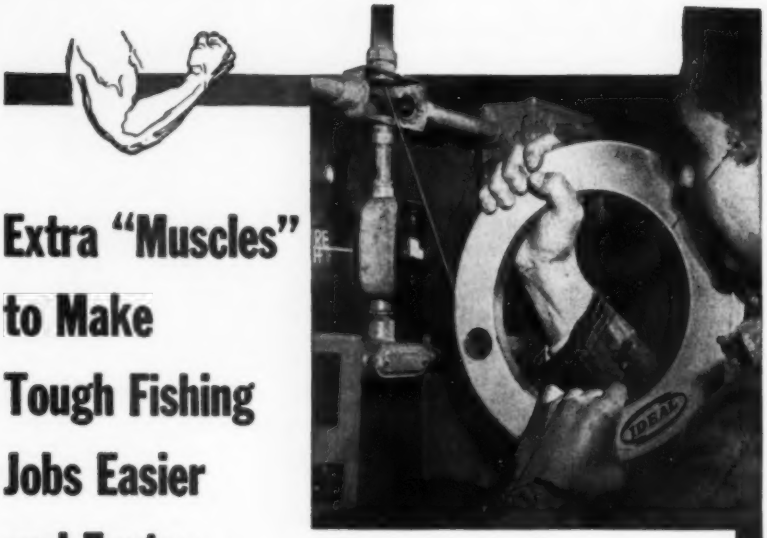
A new control system that automatically regulates indoor lighting levels in commercial buildings. Known as Light Saver Controlled Lighting, it automatically measures incoming daylight and turns artificial lighting on or off in proper amounts to maintain the desired illumination in work areas. A multi-stage operation of controlled lighting allows for gradual dimming of lights so the change is practically unnoticeable by occupants in a room. The system can be used to control either fluorescent or incandescent lights.

Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

Instrument (12)

The Megger low resistance ohmmeter is a direct-reading instrument for field and bench use. Features are—measures down to 10 microhms; open, easy-to-read, 3½-in. scale; four ranges; small size, 13 in. by 6 in. by 7 in. Two models are available, one having a battery power supply and the other a rectifier which may be plugged into any lighting circuit outlet. Instruments are provided with a quick-acting automatic circuit breaker, in the current circuit, which is actuated by a trip coil whenever the potential across the resistance being measured is excessive. Bulletin 24-46-6 is available.

James G. Biddle Co., 1316 *Arch St., Philadelphia 7, Pa.*



Extra "Muscles" to Make Tough Fishing Jobs Easier and Faster

IDEAL

FISH TAPE, REEL and PULLER

Standby of electricians for close to a generation, IDEAL Fish Tape, Reels and Pullers can help you do any wiring job faster and easier. They're like an extra arm or bigger muscles—make pulling easier and safer. The reel gives you the leverage you need — and keeps the tape always in the reel or conduit. The tape can't spring loose into moving machinery or "hot" lines.

You reel in and pull the tape through conduit in one easy operation . . . no skinned fingers —no cuts—and no lost time! The tape never gets snarled.

Saves work—saves time—saves money! The IDEAL Fish Tape Reel and Puller costs so little you can't afford to be without it! 50 to 200 foot lengths—all tapes are of finest grade, oil tempered flat spring steel.

Now Step Up the Performance of Your IDEAL Fish Tape, Reel and Puller with the

NEW IDEAL FISH TAPE WINDER

Makes IDEAL Fish Tape Reel Even More Useful

Reduces still further the work of fish tape pulling when used with an IDEAL Fish Tape Reel. As Winder is pulled around Reel it spreads the Reel housing so that the tape can be reeled in or out with least effort. Double rollers hold Winder in place as handle is rotated. Three sizes for all IDEAL Reels.

SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS
In Canada: Irving Smith, Ltd., Montreal

IDEAL INDUSTRIES, INC.
1041-B Park Avenue, Sycamore, Illinois

Please send catalog data on IDEAL Fish Tapes, Reels and Pullers and Fish Tape Winders.

Name_____

Address_____

Company_____

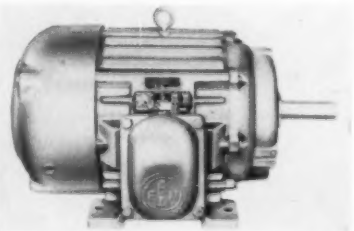
City_____ Zone____ State_____

IDEAL

Circuit Breaker (13)

400-amp molded case circuit breaker, designated NJ-400, has been redesigned. The new unit covers applications presently using J-, K-, and KL-frame sizes. UL listed, the new frame size is recommended for all 2- and 3-pole ratings from 70 through 400 amps within interrupting capacity limits defined as 15,000 amps at 600 volts ac and 25,000 amps at 240 volts ac. NJ-400 features an adjustable magnetic trip which may be set to operate over a wide range of current values, quick make-quick break mechanism, thermal time delay, common trip action, corrosion resistant bearings and both single and double, silver plated pressure type lugs. The breaker has been designed in dimensional multiples of 1⅜-in. for easy assembly coordination with other molded case circuit breakers in 2- and 3-pole combinations.

Federal Pacific Electric Company, Newark, N. J.

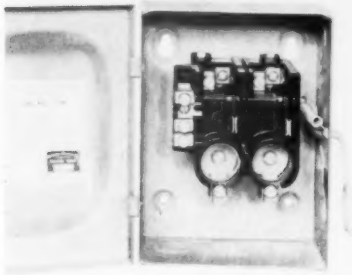


Motors (14)

A new line of totally-enclosed, explosion-proof motors designed to eliminate fires or explosions when motors must be operated in combustible or explosive atmospheres. Offered in both fan-cooled and non-ventilated models, these motors are manufactured in accordance with latest NEMA standards, and bear UL approved labels for use under the following hazardous conditions: Class I, Group D; Class II, Groups

E, F and G. Type KZCX explosion-proof fan-cooled motors are available in ratings of 1½ to 30 hp. Type KZEX explosion-proof, non-ventilated motors are made in 1½ hp ratings and lower.

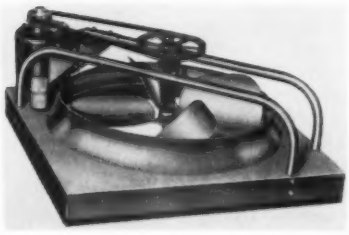
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.



Safety Switch **(15)**

A new Type "G" hp rated, 30-amp, 125-250-volt safety switch with easy to remove fuses and bakelite block. Switch is single throw, side operated, with visible knife blade construction, 2- or 3-wire. A post is provided to seal handle in "off" position and to padlock cover in closed position. Listed by UL.

Murray Manufacturing Corp., 1250 Atlantic Ave., Brooklyn 16, N. Y.



Fans **(16)**

A new line of 2-way attic and exhaust fans designed to allow either vertical or horizontal installation. The new fans with their special low design, 13½ in. high, and 2-way mounting will fit almost any attic. Available in 24-, 30-, 36-, 42- and 48-in. models, the line will feature precision balance blades, built-in Thermoguard protector, sealed-for-life ball bearings on the blade shaft, and a vibration-free resilient rubber mounted motor. A ball bearing motor will power the 24-in. through 42-in. fans. The 48-in. models will be equipped with sleeve bearing motors and are designed for vertical mounting only.

Berns Air King Corp., 3050 North Rockwell St., Chicago, Ill.

For a tight grip in tight places...

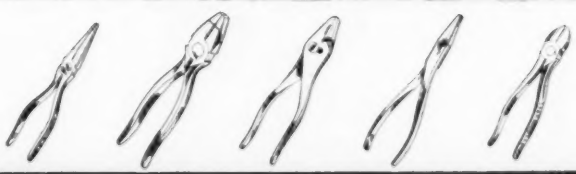
The "Mighty Midget"

CHANNEL LOCK® No. 424

• This "mighty midget" is a natural for a tight grip on small work in hard-to-get-at places. Only 4-1/2" long... drop forged from high grade steel. Four exclusive Channellock precision grooved jaw adjustments... capacity to 1/2". Skilled mechanics say it's one of the handiest pliers in their kits. You'll say so, too!

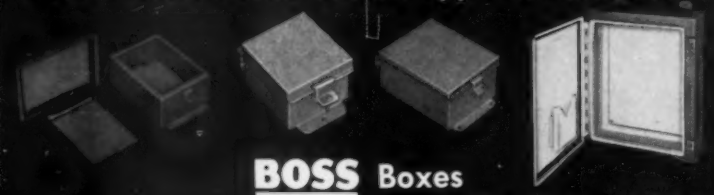
CHAMPION DeARMENT TOOL COMPANY • MEADVILLE, PA.

ASK YOUR TOOL SUPPLIER FOR A CHANNELLOCK No. 424

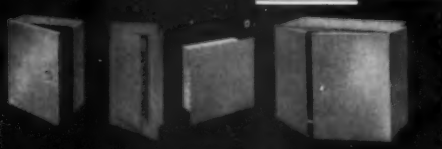


Be sure it's a genuine CHANNELLOCK
Look for the trademark on the handle

J. I. C. Boxes and NEMA Type 12 Cabinets



BOSS Boxes



Smooth corners . . . all sizes from 4½" x 5" to as large as needed. Surface or flush mount, with hinged or screw-on covers.

"The Line of Least Resistance"

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BOXES AND WIREWAY

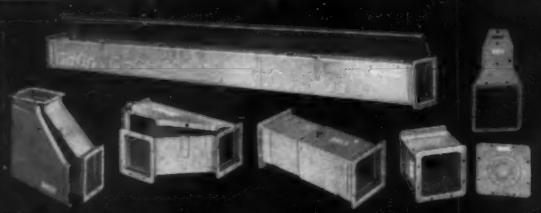
Be sure of QUALITY, positive of excellent SERVICE on stock or "specials", with the complete line of BOSS Boxes, Wireway & Fittings. UL approved.

BOSS Flangeless Hinged Cover Lay-in

Assemble and lay in wire after wireway is installed—no wire pulling or risk of damaging insulation!

BOSS Flanged Hinged Cover

Flanged on both ends . . . any number of sections can be put together. Knockouts on sides and back.



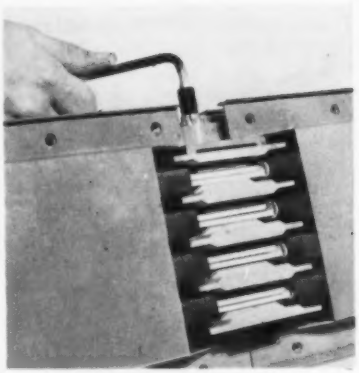
BOSS Flangeless Screw Cover

Equipped with protective screw shields. Cover has keyholes for easy removal without entirely removing screws.

Sold thru leading distributors. Write for new complete line Catalog.

THE HUENEFELD CO.

2703 Spring Grove Avenue CINCINNATI 25, OHIO



Busway System **(17)**

A busway system designed exclusively for aluminum conductors, known as Type DE. The busway is available in 3-pole and 3-phase, 4-wire designs for maximum 600-volt applications in industrial and commercial buildings. It offers as standard 50,000 amp rms asymmetrical short-circuit capacity. Some design features are—one-bolt joint that can be tightened with a single key-type wrench to exert up to a ton of force on the overlapping conductors; snap-on hangers; an adjustable length, which allows a 1-ft adjustment of a run on the job site. It also can be hung on 10-ft centers instead of five, regardless of the position in which the busway is hung. Aluminum conductors are silver-plated and tubular in design. They are encased with a heavy butyl insulation. A wide variety of fittings is available to tailor a Type DE busway system to any building contour. Several types of side- or front-operated circuit breaker plugs and fusible plugs are also available to tap the system. Complete system is listed with UL.

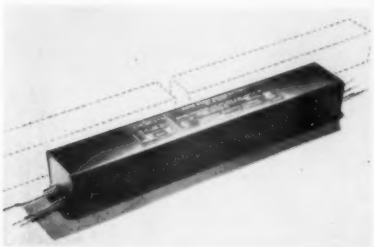
General Electric Co., Distribution Assemblies Dept., Plainville, Conn.

Ceiling Heater **(18)**

A new all-radiant industrial and commercial ceiling electric heater for use in large, open or even exposed areas. A feature of the C-257 is the amp-quartz element. A plant or large room can be completely zoned so that you heat only those areas that you wish to heat. Each panel is equipped with 22-in. sus-

pension rods that secure to ceiling, holding wires and panel in place. Unit is recommended for open or exposed areas, high ceiling buildings or rooms, show rooms and outdoor areas, under theater marquees, building lobbies, on both sides of outside doors for a curtain of radiant warmth, outdoor cafes, etc.

Ampere Industries, 60 Boston St., Newark 3, N. J.



Ballasts **(19)**

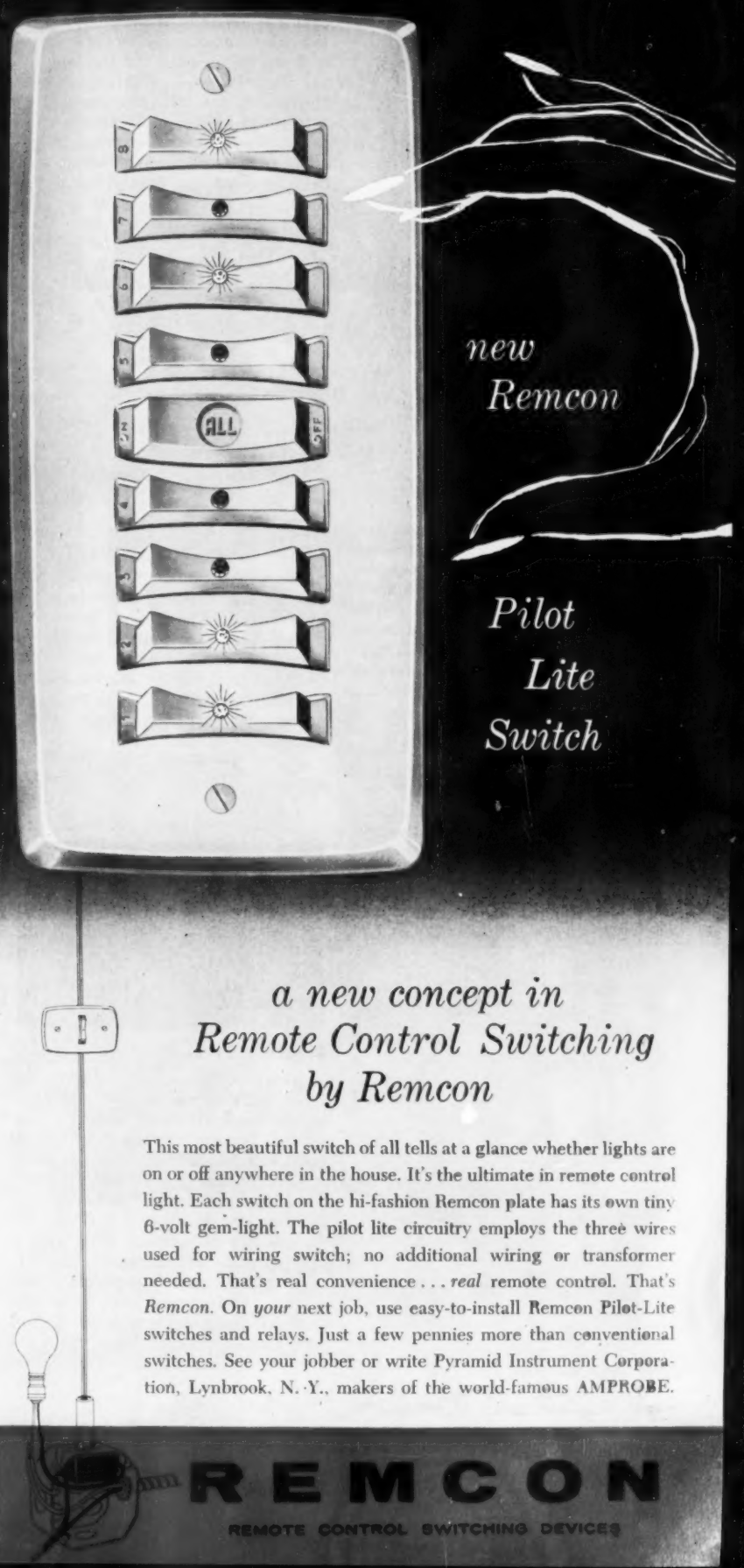
A new line of one can fluorescent ballasts for 4-, 6- and 8-ft power groove and V-O lamps for cold weather operation have been developed. New ballast design saves up to 8 lbs per unit and 12 1/8-in. length per unit over two can ballasts.

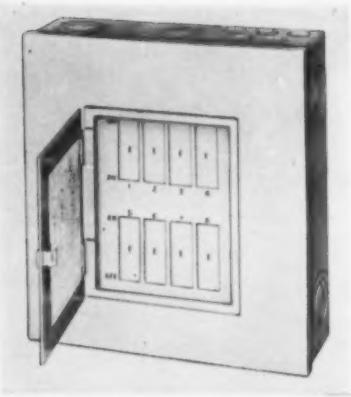
Jefferson Electric Co., Bellwood, Ill.

Autoformers **(20)**

Three new explosion-proof variable autoformers are now available for controlling power line voltage in hazardous areas. Designed especially for panel mounting, the units feature cast aluminum housings and compact construction. Model 6240 has a power input of 120 watts, 60 cps and output of 0-140 volts, 7.5 amps, 1.0 kva maximum. It is normally supplied with a Superior Electric Company Type 116 Powerstat. Medium size Model 7001 has an output of 0-135 volts, 3 amps, and has a Type 20 Powerstat. Small size Model 7009 has an output of 0-132 volts, 1/25 amps with a Type 10 Powerstat. Technical bulletins are available.

I-L-S Instrument Corp., 4574 West 160th St., Cleveland 11, Ohio


ALL
ON
OFF
new
Remcon
Pilot
Lite
Switch
a new concept in
Remote Control Switching
by Remcon
This most beautiful switch of all tells at a glance whether lights are on or off anywhere in the house. It's the ultimate in remote control light. Each switch on the hi-fashion Remcon plate has its own tiny 6-volt gem-light. The pilot lite circuitry employs the three wires used for wiring switch; no additional wiring or transformer needed. That's real convenience . . . real remote control. That's Remcon. On your next job, use easy-to-install Remcon Pilot-Lite switches and relays. Just a few pennies more than conventional switches. See your jobber or write Pyramid Instrument Corporation, Lynbrook, N. Y., makers of the world-famous AMPROBE.
REMCON
REMOTE CONTROL SWITCHING DEVICES



Load Center **(21)**

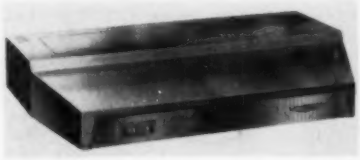
100-amp circuit breaker load center is designed to take the "E-Z-Red" circuit breakers 15 to 50 amps, single and double poles or 15-20-amp switching neutrals for gas stations. Enclosure is available in either the indoor, surface and flush, or outdoor type for six to eight circuits. With Wadsworth sequence bus design any two adjacent breaker positions may be double pole, the maximum combination of the 6-circuit load center will take one to six single pole breakers or three double pole and the 8-circuit will take one to eight or four double pole breakers. The enclosure is for 3-wire service, solid neutral 120/240 volts ac. They are equipped with line side lugs, including neutral, which are silvered. The surface type is equipped with the new "hook-on" door trim. For flush mounting types the interior assembly is attached to a "self-aligning" metal plate. It is listed by UL.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

Connectors **(22)**

A new line of liquid-tight conduit connectors with insulated throats has been designed to protect conductors from abrasion at termination points in liquid-tight flexible conduit. The insulated throat covers the edges of the connector to provide a smooth path for the conductor while it is being pulled through the connectors. The new connectors retain the steel grounding cone and nylon sealing ring features of the standard liquid-tight flexible conduit connectors. Straights, 90-degree and 45-degree elbow designs are available in the new line. Each connector type is available for conduit sizes from ⅜ through 4 in.

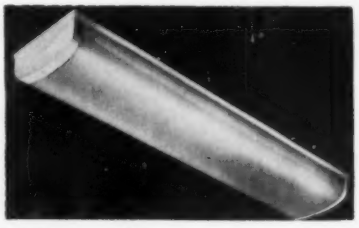
Thomas & Betts Company, 36 Butler St., Elizabeth, N. J.



Range Hood **(23)**

A new series of ventilating range hoods with "Flip-Top" construction and tapered mitered sides is available in RadioHood, a new prewired hood-fan and a series of standard hoods. The RadioHood features a built-in 5-tube superheterodyne radio, 3-speed pushbutton control of fan and light in 36-, 42- and 48-in. lengths.

Berns Air King Corp., 3050 No. Rockwell St., Chicago, Ill.



Lighting Fixture **(24)**

New unbreakable fluorescent light fixture, called Security, has many applications in schools, hospitals, institutions and municipal installations. The fixture fits flush against ceiling or wall and its plexiglas lens can resist virtually any human attack upon it. It can be opened for re-lamping only with a special tool. When closed, the fixture is dust and bug-proof. Completely waterproof, it can be washed down with a hose at full pressure. Available in units to carry two, three or four fluorescent lamps. It is finished in white baked enamel.

Ruby Lighting Corp., 802 West Whittier, Calif.

BRONCO 66 CERTIFIED

quality flexible large electrical cables FOR SAFE, CONTINUOUS DUTY UNDER EXTRAORDINARILY RUGGED CONDITIONS

JACKET is certified by a registered professional engineer to contain not less than 67.32% Neoprene for maximum protection against oil, ozone, acids, flame . . .

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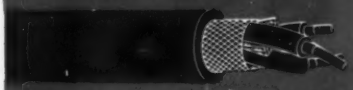
P116BM branded into these jackets is the symbol for official approval by the Pennsylvania Bureau of Mines and acceptance for listing by the Federal Bureau of Mines.

FLAT TWIN PARALLEL

600 Volt Cable is designed especially for use on the take-up reels of mine locomotive and mine machinery. It is made in both W and G types in sizes from 8 a.w.g. through 4/0 with either coarse or fine stranding.

HIGH VOLTAGE — 2001 to 15000 VOLTS

Bronco 66 Certified is made as both Type W and Type G portable cables. It is available in sizes 8 through 1 with three or four conductors, with flexible or extra flexible stranding. In Type RR it is available from 600V to 15KV both shielded and unshielded.



RETRACTABLE REEL CABLES

are 600 Volt cables built with special reinforcement for prolonged service on the payout and retractable reels used with lifting magnets, mine trailer cables, dragline cables, etc. Made in sizes 8 through 1 with 2, 3, or 4 conductors.

ORDER THE LENGTH YOU REQUIRE. IT WILL BE SUPPLIED AT NO ADDITIONAL COST.

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10 LOCAL AND 3 CENTRAL SERVICE CENTERS THROUGHOUT THE COUNTRY . . . OVERNIGHT SERVICE TO ANY CITY IN THE COUNTRY.

WESTERN INSULATED WIRE CO.

Manufacturers of portable electrical cords and cables

LOS ANGELES 58, CALIFORNIA

FLAT TWIN PARALLEL TYPES W&G MINING CABLES

HEAVY DUTY

BRONCO 66

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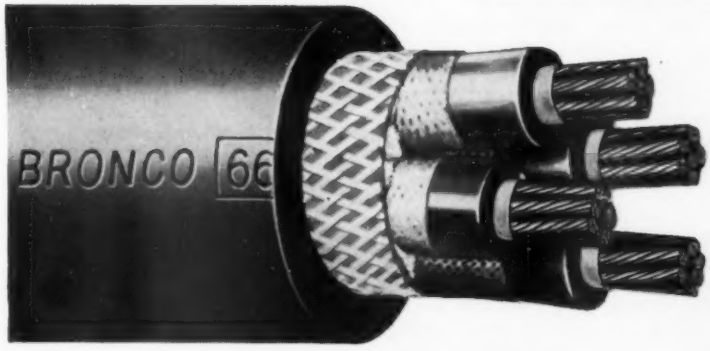
67.32% NEOPRENE JACKET

LARGE CABLES



HIGH VOLTAGE TYPES W, G, AND RR CABLES

RETRACTABLE REEL CABLES

lighting
design
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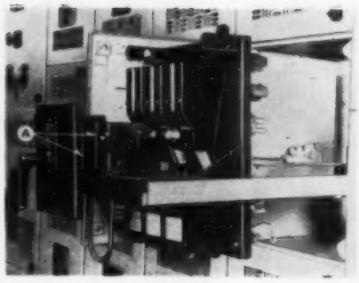
Cast Aluminum Quality

mcPhilben's 32-88 square ceiling unit is UL-approved for two 100 watt lamps. Its clean, modern lines, combined with maintenance-free operation, make it the ideal choice for institutions and industry: corridors, lobbies and lavatories.

The 32-88's face plate is of solid cast aluminum with a gleaming satin finish. Corrosion resisting construction features a reinforced and insulated back plate of zinc-clad bonderized steel. The cast carrara glass bowl swings to one side for easy cleaning. Available with mcPhilben's exclusive one-piece cast aluminum hinged guard. Also in vaportight 43-88 series.

Ask your nearby mcPhilben representative for full details. See our insert in Sweet's file 32a/mc or write for data sheet.

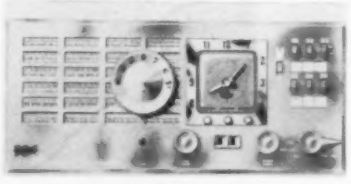
mc Philben
LIGHTING COMPANY
1329 Willoughby Avenue
Brooklyn 37, New York



Air Circuit Breakers **(25)**

A new Type DB, 600-volt, 15 to 4000 amps, metal-enclosed switchgear with 3-position breaker design. The interrupting rating of the units are from 15,000 to 100,000 amps. With the circuit breaker in any of its three recognized positions—connected, test and disconnect—the door of the breaker compartment can be closed. Indication of breaker position is provided by two white lines on the mechanism. The 3-position feature offers additional convenience and safety to operating and maintenance personnel, and greater protection for the circuit breaker. Trip action on the DB-25 and DB-50 is accomplished by a separate pushbutton.

Westinghouse Electric Corp., P. O. Box 2099, *Pittsburgh* 30, *Pa.*



Radio-Intercom Unit **(26)**

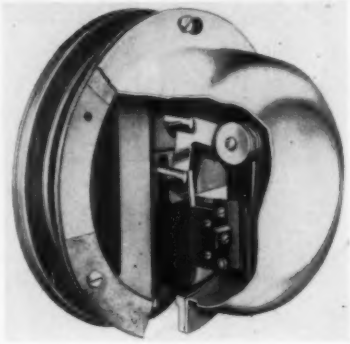
A new home radio-intercommunication unit, known as Sound Guard, provides flexible, two-way communication between a master unit and as many as six remote units, and between the remote units themselves. Master unit includes a radio which may be heard as desired at any or all intercom stations. An electric clock turns the intercom as well as household appliances on and off at preselected times. Provision is also made for a phonograph attachment. An outdoor remote unit permits conversations with callers while the door is closed.

Progress Manufacturing Company, Inc., Philadelphia 34, *Pa.*

Electric Heater **(27)**

A new 750-watt electric radiant glass heater designed for wall surface mounting. Model HBT has a maximum thickness of 3 in. including the metal guard. Width is 12⅝ in. and height 17¼ in. A built-in thermostat permits automatic functioning through a wide range of temperatures. Available in 120, 208 and 240 volts. UL approval.

Berko Electric Mfg. Corp., 212 *Jamaica Ave., Queens Village, N. Y.*



Indicator and Control **(28)**

Improvements have been made in the Bin-Dicator, an automatic bin level indicator and control unit. It has a twist lock cover, and slotted hex head screws which need only to be loosened so that cover can be turned and lifted, exposing the operating mechanism. Unit has a vented housing, which relieves any pressure built-up in the housing as the diaphragm is flexed in response to pressure of material in the bin, silo, hopper or chute. The Bin-Dicator is essentially a diaphragm-operated switch for operation on all bulk materials that flow through a bin.

Bin-Dicator Co., 13946 *Kercheval Ave., Detroit* 15, *Mich.*

Control **(29)**

Type B 95 temperature control, explosion-proof, Class I Group C & D, unit was designed for use in hazardous locations where explosive vapors or gases are present. Temperature settings are made by rotating a single turn knob and pointer against a calibrated dial. Any one of three standard switches are available: normally open, normally closed, or double throw with no neutral position. All switches are single pole, suitable for 180°F ambient temperatures and are rated for 15 amps at 115/230 volts ac. The thermal system consists of a bellows contained in a bellows housing.

United Electric Controls Company, 79 *School St., Watertown* 72, *Mass.*

NO MORE WASTE when you cut a length of new SLIPKNOT #7 PLASTIC ELECTRICAL TAPE . . . and no more struggling to cut it, either. Because Slipknot's newly developed all-plastic tape cutter (pat. pending) rides the roll, and gives a quick clean cut when and where you want it. No more stretching and thinning the next several inches. Try new SLIPKNOT #7 with ZF-90 — Plymouth's formula for total adhesion — on your next job. You'll like it, and you'll appreciate the cutter, packed free* in every 66-foot can.

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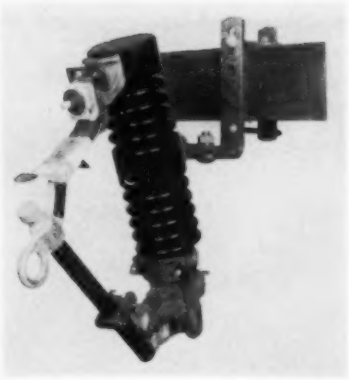
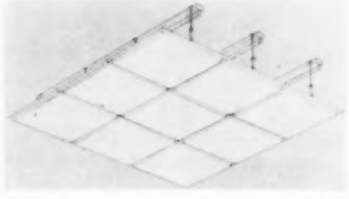


Cutouts **(30)**

Extra heavy duty cutouts with twice the interrupting capacity of the existing heavy duty units are now available. A new design of the fuse link holder enables the 7.8 kv cutouts to be boosted from 5,000 to 10,000 amps and the 15 kv line from 4,000 to 8,000 amps rated interrupting capacity at 60 cycles. The fuse holder, made of fiberglass reinforced polyester resin, has an expandable cap action. The fuse holders are interchangeable with previous models and can be used in many existing G-E open cutout frames.

General Electric Co., Distribution Transformer Dept., Schenectady 5, N. Y.



Ceiling **(31)**

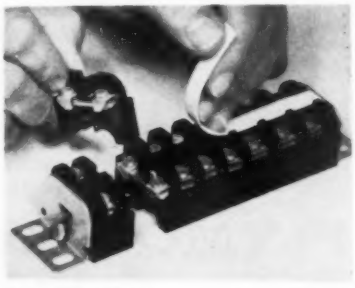
A variety of wall-to-wall ceiling designs can be laid out through the process of combining standard components. The designer can develop his design at will, choosing from a selection of diffusers and louvers varied as to style, pattern, texture, material and size. All grid Tees are indexed on 12-in. centers. Electrical channels run crosswise to the runner Tees. Tees and wall angles are finished extruded aluminum. Color filters for the 2-ft by 2-ft patterned diffusers come in standard pastel tints or pink, yellow and green, suitable for color interiors where accent or repeat of design is desired in the ceiling. Additional color may be considered by the designer through the use of acoustical baffles, which may be painted to suit interior. Where the diffuser or louver cannot be cut to fill out room size, a luminous metal filler is supplied, suitable for shearing to size in the field. It is available in white and in pastel shades of pink, yellow and green.

The Wakefield Company, Vermilion, Ohio

Transformers **(32)**

Changes have been made in this line of lighting transformers, from 5 through 37½ kva. These units are now designated as Type "W". New Silicore wound core is used. Another feature is the liberal use of large air ducts. Extra space between both coils and windings also gives greater protection against both coil to coil breakdown and layer to layer breakdown. Another feature is low decibel level.

Marcus Transformer Co., Inc., Rahway, N. J.



Terminal Block **(33)**

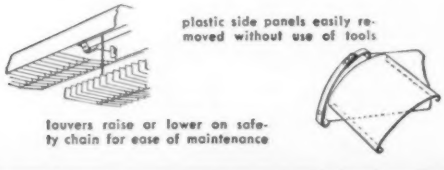
A new compact terminal block is available for custom assembly or in factory assembled strips rated at 600 volt ac or dc, 15-, 25-, and 50-amp ratings. Features are snap in marking strip, snap on terminal block, both of which make modifications to a mounted terminal strip a fast operation. Standard 3/6-in. round cold rolled steel fit each molded piece and permits rapid assembly of special requirements.

Gemco Electric Company, 25685 W. Eight Mile Road, Detroit 40, Mich.

Pacesetter in the Lighting Industry

Here is America's newest, most feature-packed direct-indirect luminaire. The Daystar's long smooth-flowing appearance, its simplified ultra-thin design, plus its efficient output of high levels of quality illumination make it ideal for use in today's modern classrooms, offices, stores and other commercial interiors.

The Daystar is available in 48 and 96 inch lengths with 35° crosswise and 25° or 45° lengthwise shielding. The side panels are of steel baked white enamel or plastic. The steel baked white enamel louvers have a special snap-in catch and raise or lower on a safety chain for ease of relamping and maintenance. For complete data of all the new Daystar features that make other direct-indirect units obsolete, mail the coupon today!



LIGHTING PRODUCTS INC., HIGHLAND PARK, ILLINOIS

LIGHTING PRODUCTS INC., No. 1503
Dept. 4-B, Highland Park, Ill.

Name_____

Firm_____

Address_____

City_____ State_____

Latrobe *Electrical* Products

"Latrobe" Floor Boxes and Wiring Specialties are top performers because they are expertly designed of the finest materials.

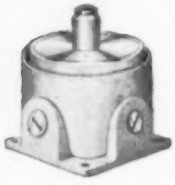
"Latrobe" Products are proof that the shortest road to efficiency and economy lies through quality.

Non-Adjustable Watertight Floor Box

Unique, practical design cuts installation time, makes safer job and leaves more wire space inside box. Cover Plate is 3½" diameter

Adjustable Floor Box

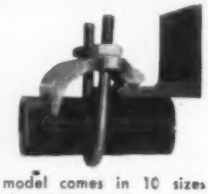
Designed for telephone outlets or where permanent connections are made, or as a junction box. All adjustable boxes are fire proof.



Insulator Supports

Fasten porcelain or glass insulators to steel framework without punching holes. 3 sizes—1", 1½", 2" and 2½"

"Latrobe" Pipe or Conduit Clamp



This clamp is made with a double safety bite of case hardened tool steel. Two models — Right Angle and the Parallel support. Each model comes in 10 sizes to handle pipe or conduit ½" thru 4".

Latrobe Products

Non-Adjustable Floor Boxes
Adjustable Floor Boxes
Gang Boxes . . . Cover Plates
Junction Boxes . . . Nozzles
Pipe or Conduit Hangers
Insulator Supports
Cable Supports . . . Fish Wire
Staple and Cable Clips

Write for new catalog

Sales Representatives in all principal cities.

Fullman Manufacturing Co.

1209-1215 JEFFERSON STREET

LATROBE, PA.

Test Set (34)

New Model 2 dielectric test set for measuring dc at voltages up to 100 kv when applied to the insulation of electrical equipment such as generators, transformers, bushings, cable, etc. In the improved Model 1A, 40 kv set and the new Model 2, 100 kv, a polarized primary has been incorporated which prevents the set from being raised above ground potential. Also included is a high voltage reset button which prevents the high voltage output being energized without the operator's knowledge. Bulletin 22-6 is available.

James G. Biddle Co., 1316 *Arch St., Philadelphia* 7, *Pa.*

Intercom (35)

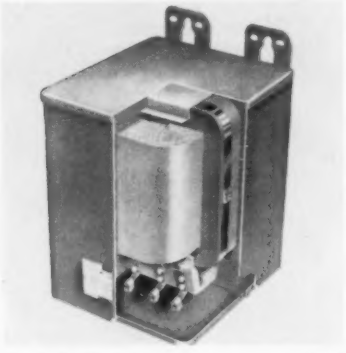
Five home intercom models for every purpose, wireless if required or wired if convenient, are available in enamel colors. The wireless electronic nurse is one unit; Wire-Less-Com, two stations; E-Z Talk, two stations; Small Talk, two stations; and Econofone, master for five stations.

Mark Simpson Manufacturing Co., Inc., 32-28 49*th St., Long Island City, N. Y.*

Secondary Racks (36)

New electro-forged secondary racks are 2-, 3-, or 4-wire types and available in either extended or non-extended back styles. They are light-weight yet sturdy for supporting high dead-end and cantilever loads. Their oval-shaped legs provide broad non-abrasive surfaces for safe wire stringing. They are hot-dipped galvanized to resist corrosion.

Line Material Industries, Milwaukee 1, *Wis.*



Transformers (37)

A new line of dry-type specialty transformers, Type EP, are particularly suited to application to electrical machinery, panelboards, and general commercial installations including hospitals, offices, and schools. Core and coils of units are completely encapsulated in resin with filler, providing a sealed unit that can be installed in hazardous areas. Transformers are available in ratings from ¼ to 10 kva, 600 volts and below, and can be mounted in any position on wall, floor, or ceiling. Ratings 3 to 10 kva are suitable for outdoor use. All ratings carry UL approval.

Westinghouse Electric Corp., P. O. Box 2099, *Pittsburgh* 30, *Pa.*

Electric Motors (38)

A new line of electric motors with new NEMA dimensions and specifications are for use in all industries and are available in frame sizes 182 through 326U and hp ratings of ½ through 40. Either drip proof or totally enclosed fan cooled. The NEMA rerated motors feature all-aluminum alloy frames. Literature is available.

Reuland Electric Company, Alhambra, Calif.

LOWER LIGHTING COSTS

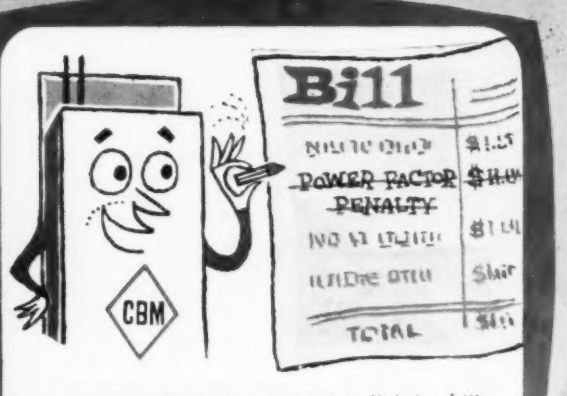
with fluorescent fixtures using

CERTIFIED CBM BALLASTS

UP TO 2500 HOURS MORE LAMP LIFE in fixtures using Certified CBM Ballasts. And rated light output, too. That's what tests by fluorescent lamp makers show.

TROUBLE-FREE SERVICE . . . for Certified CBM Ballasts provide assured ballast life . . . quiet operation . . . minimize replacements and repairs.

MADE TO EXACTING SPECIFICATIONS for performance by 8 leading ballast manufacturers, CBM Ballasts are checked and certified by ETL. And they're UL listed, also.



NO POWER FACTOR PENALTY on lighting bills because Certified CBM Ballasts are High Power Factor. (Saves on installation costs, too!)

WRITE FOR FREE BOOKLET
"Why High Power Factor Ballasts cut your lighting costs"

Eight leading manufacturers now make up

CERTIFIED BALLAST MANUFACTURERS

2116 KEITH BUILDING • CLEVELAND 15, OHIO

Participation in CBM is open to any manufacturer who wishes to qualify

CBM-6-CU

QUAD LIGHTING

INDOOR . . . QUADRANGLE . . . OUTDOOR

FINEST QUALITY ILLUMINATION
for year 'round profitable sales

★ Easy Tach RLM STANDARD DOME

Any size or style of QUAD socket type reflector with hex hole may be converted to the quick connecting and disconnecting type by substituting the simple to use EASY TACH socket for the regular one-piece ½ inch medium or mogul socket.

★ SAFETY HOOD RLM GLASSTEEL DIFFUSER

An all white unit with opal glass globe and perforated reflector to provide maximum diffusion with upward light component. Safe and easy to maintain—free from objectionable brightness, glare, or shadow.

★ RLM SYMMETRICAL ANGLE

This style reflector is being sold particularly where side mounting industrial illumination is required. With weatherproof sockets, it is also suitable for outdoor use. Illuminates a wide area and affords desired eye shielding.

★ RLM DEEP BOWL

Sold where localized lighting is required such as for machine tools, over work benches, and along production lines—also where high intensity illumination is needed over a small working area.

★ Easy Tach RLM HIGH MOUNTING REFLECTOR

Adapted for use in industrial plants to provide uniform illumination where mounting heights equal or exceed the spacing distance. This type reflector is entirely weatherproof so that it can be sold for outdoor applications as well as indoor. This unit is also being used for gymnasium lighting. Also available in standard socket reflector construction as well as with EASY TACH.

See the complete line in our reflector catalog No. 10.

QUADRANGLE MFG. CO.
325 S. PEORIA ST. CHICAGO 7, ILL.

Capacitor Equipment (39)

New small housed capacitor equipment for use on both indoor or outdoor primary distribution circuits is for application on industrial and utility systems and may be installed close to low power factor leads. Standard 3-phase equipment consists of a weatherproof housing, single-phase capacitor units, buswork, fuse clips, and one current-limiting fuse per capacitor. Equipments are rated 45 to 180 kvar, at 2.4/4.16 kv, and 90 to 180 kvar at 4.8 and 7.2 kv. Weatherproof housing is of all-welded steel construction, is well ventilated, yet designed to prevent entrance of rain or rodents. Underground entrance for either cable or conduit is made through bottom.

General Electric Co., Capacitor Department, Hudson Falls, N. Y.

Trenching Machine (40)

A new self-propelled light trenching machine, Model C Ditch Witch, is powered by a 7 hp air cooled gasoline engine and will dig trench 3 in., 4½ in. or 6 in. wide to depths up to 2 ft. Trenching speed is about 4 ft per minute. Machine has been designed for installation of underground wiring, lawn sprinkler system, gas services, water lines, telephone services, street lighting and signal systems.

Charles Machine Works, Inc., 626 *Birch St., Perry, Okla.*

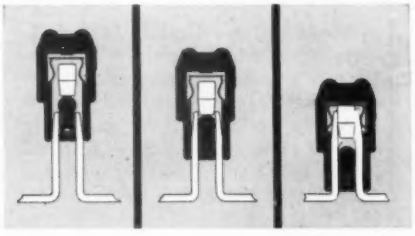
Clampmatic® control

guarantees positive switching, longer switch life

For quick-make, quick-break action . . . *absolute switching security* . . . you can't beat BullDog's Clampmatic Control switch unit. Featured in BullDog bus plugs, safety switches, power panels and switchboards, it meets today's electrical needs with more efficiency, less maintenance, greater safety than any other available switching unit.

The exclusive Clampmatic action on line and load jaws doubles the pressure on the movable contact slug. It assures bolt-tight electrical contact when charged . . . and accelerated break when de-energized. The result is cooler operation which provides long and trouble-free switch life. In addition, the Vacu-Break® enclosing head smothers arcs, minimizes pitting and burning of contacts.

Give your clients positive switching security with BullDog Clampmatic control. For complete details consult your BullDog field engineer or write BullDog Electric Products Co., Detroit 32, Michigan. © BEPCO



"Off" position; switching to "on"; "on" position—Clampmatic Control assures bolt tight contact, quick-break action. Circuits open with minimum arcing.

The BullDog field engineer demonstrates large scale model of Clampmatic principle shown at left. Clampmatic-controlled switch units include (top to bottom): Vacu-Break Bus Plug, Safety Switch and units for switchboards and panelboards.

BULLDOG

BullDog Electric Products Co., Detroit 32, Mich. A Division of I-T-E Circuit Breaker Co.
BullDog Export Division: 13 East 40th St., New York 16, N.Y.
In Canada: BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

Observing NATIONAL ELECTRICAL WEEK

action—
WHEN YOU NEED IT MOST!

HILL 2000 KVA power transformer (13.2 to 2.4 kilovolt delta) loaded for shipment to White Bluff Pumping Plant No. 1, Columbia Basin Project, Washington. Ordered through electrical wholesaler for the Bureau of Reclamation.

When you need an immediate answer to a transformer problem—check first with HILL. You'll find HILL's production and delivery schedules a definite help. Power and distribution transformers up through 5000 KVA for every application—designed to your exact specifications, manufactured to NEMA and ASA standards.

OIL FILLED • ASKAREL
DRY TYPES

HILL

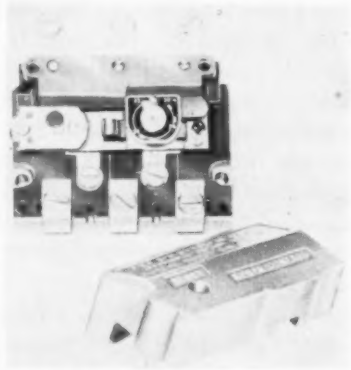
HILL TRANSFORMER CO., INC.
1030 WASHINGTON STREET
SAN CARLOS • CALIFORNIA

Available through leading electrical wholesalers

Brake **(41)**

A new Style "HTC" 50 Series brake for use with fractional horsepower electric motors in frames 56-C and 66-C, also integral motor frames 182 and 184. It is designed for use on stub, extended, or thru shaft applications. Furnished with cast iron housing and endplate, visual wear indication, and automatic manual release and reset. Brake is available for operation on all standard ac voltages.

Stearns Electric Corp., 120 North Broadway, Milwaukee 2, Wis.

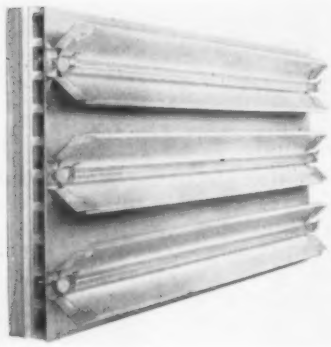


Overload Relay **(42)**

A newly designed overload relay, called the Type "SD". To assure accurate response over a range of approximately 25% of the motor current at temperatures varying from minus 24°C to plus 55°C, type "SD" overload utilizes directly heated bimetal elements which are not materially affected by normal ambient changes. Thermal elements for normal trip, quick trip or slow trip can be furnished on any overload in the new line. Normally adjusted for manual reset, the relay can be changed to automatic reset at the factory in the field by removing cover and turning screw. Control circuit contacts of "SD" are single-pole double-throw switches, providing the standard normally closed

circuit for controlling the contactor and a normally open circuit from the same source to control another circuit, such as an alarm system.

Rowan Controller Co., 2315 *Homewood Ave., Baltimore* 18, *Md.*



Radiant Heaters **(43)**

A new line of tubular infra-red radiant heaters for use in ambient temperatures up to 1000°F, can be used for baking, drying, curing, dehydration, degreasing, preheating, vulcanizing and other industrial applications. Called "Vicoray", the line is available in both panels and individual tubular elements completely wired and ready to be erected and connected for use. Units come in both 120- and 240-volt but can be wired in series for use with 480 volts if desired. The line ranges in wattage from 500 watts up to panels of 36 kw. Size range extends from 11 in. to 48 in. Catalog is available.

Douglas C. Whitaker Company, Inc., 141 *E. Glenside Ave., Glenside, Pa.*

Arresters **(44)**

New heavy-duty arresters combine an external gap with the electric characteristics of valve and internal-gap construction. Available voltage ratings are 3-, 6-, 9- and 10-kv. Arresters for crossarm, pole and wall mounting, designated type TX, have an external gap insulator. Type T arresters are mounted directly on transformers or regulators. The pyrex housing provides positive and constant visible evidence of an arrester's ability to give protection. The open series air gap and internal gap of T and TX arresters can each withstand normal line operating voltages.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, *Wis.*

LEVITON *specification grade*
Switches and Receptacles

Compare Leviton wiring devices under any conditions . . . Leviton gives you the utmost in performance at minimum cost . . . with absolutely no compromise in quality.

SPECIFICATION GRADE INCLUDES

The Complete "5000" Line
Combination Line
Lev-O-lock Line
Quickwire Line
U-grounding Devices
Interchangeable Devices
Lev-O-let Line

CHECK THESE TYPICAL FEATURES

- Heavily sectioned molded phenolic bases.
- Full gauge straps, completely rust proofed and riveted to assemblies.
- Plaster ears — wide and break-off types.
- Terminal screws with large heads to accommodate No. 10 conductors and backed out for quick wiring.
- Individually packed with mounting screws attached to straps.
- All switch mechanisms utilize high grade bronze for wide, double wiping contacts.
- Assemblies riveted for permanence.
- All power outlets have double-wiping phosphor bronze contacts.
- Meet U.L., C.S.A. and Federal Specifications.

LEVITON

Samples on Request

LEVITON MANUFACTURING COMPANY
BROOKLYN 22, N. Y.

Chicago • Los Angeles • Leviton (Canada) Limited, Montreal
For building wire and cable contact our subsidiary: AMERICAN INSULATED WIRE CORP.

CLARK-AMERICAN SERVICE ENTRANCE EQUIPMENT

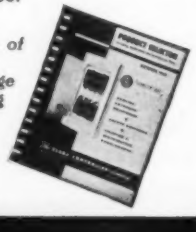
• More and more contractors insist on using Clark-American Service Entrance Equipment because it saves them time and cost on house wiring jobs. They know, too, that once installed it can be counted on to give dependable, trouble-free service, avoiding costly repair calls.

The fact is that every construction detail has been carefully planned to make installation faster and easier. And every step in production is rigidly controlled to maintain Clark's high quality standards.

FEATURES INCLUDE:

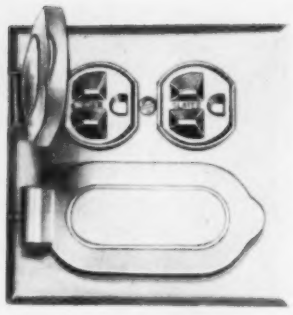
- Baked-on grey enamel finish
- One-piece trim and door
- Cover easily removed
- Plenty of knockouts, conveniently located
- Knockouts easily removed
- Generous wiring space
- Slotted upper mounting holes
- Solderless lugs on line, range and sub-feed terminals
- Wire-binding screws on plug fuse terminals
- 100 Ampere capacity plated line lugs
- Non-interchangeable pullouts
- Wiring diagram inside door

Write for your free copy of the CLARK-AMERICAN *"Product Selector"—32-page book with complete catalog plus application and installation data.*



American
ELECTRIC SWITCH DIVISION

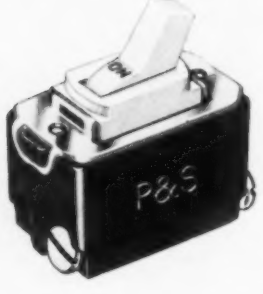
The CLARK CONTROLLER Company
Engineered Electrical Control • 1146 East 152nd Street • Cleveland 10, Ohio



Receptacle **(45)**

A weatherproof 2-gang duplex U-ground assembly with dual sealtight spring-hinged cover is designed to withstand snow, ice and rain. It is also suited to interior installations where excessive moisture is, or is apt to be present. The assembly may be used in metallic or non-metallic wiring systems for grounding metal parts of appliances or tools. Available with 15-amp, 125-volt, 15-amp, 250-volt, and parallel slot 15-amp, 125-volt receptacles. UL approved.

Perfect-Line Mfg. Corp., Old Country Rd. & RR Ave., Hicksville, N. Y.



Switches **(46)**

A new line of ac quiet switches for residential use includes a strap type for conventional installation and interchangeable P&S-Despard types for double or triple combinations. AC11 strap type switch, rated at 15 amps, 120 volts, is available with binding screw terminals or pressure type screwless terminals. Unit with binding screw terminals can be ordered in single pole, double pole, 3-way or 4-way design. Pressure terminals model is available in single pole, single pole with ground shunt, single pole with line shunt, double pole, 3-way, 3-way with line shunt and 4-way. The 15-amp ACD1 rated at 120-277 volts, with binding screw terminals

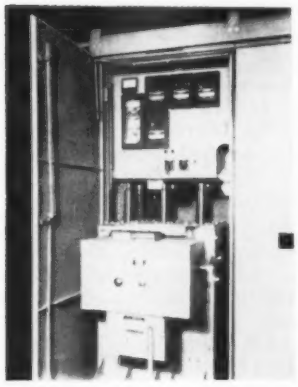
is available in single pole, double pole, 3-way and 4-way. Type ACD11 with pressure terminals is rated at 15 amps, 120-277 volts. This unit is available in single pole with line shunt design, double pole, 3-way with line shunt and 4-way. The 20-amp Type ACD201 with binding screw terminals has a range of 120-277 volts. Listed by UL. Literature is available.

Pass & Seymour, Inc., Solvay Station, Syracuse 9, N. Y.

Receptacle (47)

Easily accessible terminal screws located on the top side of new porcelain pullchain receptacle. It can be mounted on either a 3¼ in. or 4-in. outlet box since it has a 4⅜-in. outside diameter. A glazed chain channel facilitates free operation regardless of angle at which receptacle is mounted. Rating is 250 watts, 250 volts. Literature is available.

Circle F. Mfg. Co., Trenton 4, N. J.



Switchgear (48)

A newly designed, outdoor metal-clad switchgear equipment that provides control panels on the same side of the unit as the breakers. The equipment, suitable to both utility and industrial application, is rated 2.4 to 13.8 kv, 50 to 1000 mva. Units are reduced in depth with no addition in width. With breakers, relays and controls on one side, maintenance and testing is made easier. Control panel is mounted on an inside "dutch door" that swings out to provide access to bus connections. Breakers may be removed without disturbing the panel.

General Electric Co., Medium Voltage Switchgear Department, Philadelphia, Pa.

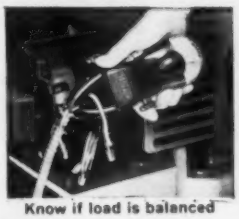
don't guess!
AMPROBE
IT!

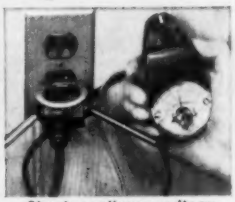
AMPROBE RS-1
only $39.85
with Rotary Scales, has 4 current ranges 0-5/15/40/100 and 2 volt ranges 0-150/600.

There's nothing like an AMPROBE for fast and profitable trouble-shooting. Wrap-around feature makes it simple to read current without shutdowns. Multiple current and voltage scales permit you to test most everything in sight with a single instrument.

There's an AMPROBE for every job, every budget... from 10 amps and 250 volts to 1200 amps and 600 volts AC. Prices from $19.85 to $67.50—so you can't afford *not* to own one. See them at your jobber today. Pyramid Instrument Corp., Lynbrook, N. Y. Manufacturers of famous REMCON simplified low-voltage switching devices. In Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto, Canada.

13 models to make your work easier, faster, surer


Know if load is balanced


Check appliance voltage at receptacle

Take current readings without shutdowns

GO AHEAD...

explain nuisance tripping to him

Heat's on, conditioner's out. How come?

Some annoying power interruptions are due to inadequate wiring. A vast number are due to nuisance tripping of circuit breakers or nuisance fuse blowouts.

Fuses and many circuit breakers operate on the basis of heat. They are sensitive to heat from within the circuit and without. Thus, on hot days thermal protectors are often near the tripping point even though the circuit is not fully loaded. As heat builds up, nuisance tripping results.

Heinemann hydraulic-magnetic circuit breakers *ignore heat*—respond only to *current* (amperage) which is the true determinant of electrical load. These circuit breakers will carry the full, safe capacity on the hottest days. Nuisance tripping just doesn't occur.

In Heinemann circuit breakers, actuation is entirely magnetic; inverse time delay is provided by hydraulic means. When protection is needed, interruption is fast. When the circuit is safe, power stays ON.

***For consulting engineers,* the full story is given in an informative booklet, Manual 101: "What You Should Know About Circuit Breakers." Write for your copy.**

HEINEMANN

HEINEMANN ELECTRIC COMPANY
132 Plum Street, Trenton 2, N. J.

Circuit breakers

SA 1418

Switch **(49)**

A new remote-control switch, called the "Pilot-Lite Switch" features built-in monitors for every light that the plate controls. Each switch on the plate has a small light that shines when the switch is "on", making it possible for the homeowner to know what lights are burning in all rooms and on all floors without making a tour of the house.

Pyramid Instrument Corp., Remcon Division, Lynbrook, N. Y.

Product Briefs

(50) Lightolier, Inc., 346 Claremont Ave., Jersey City 5, N. J., has introduced a new collection of wall and ceiling **fixtures,** called "Rhapsody".

(51) Union Carbide Corporation, New York, N. Y., has announced new R-610 silicone which is a new **varnish** developed especially for coating and bonding Class H electrical insulation components. . . . (52) A new, 3-cell model, electrical circuit continuity **tester** for low resistance circuits, with a 50% increase in capacity, is being produced by Bright Star Industries, Clifton, N. J. . . . (53) Additional fastener holders and drive rods, designed to further broaden the uses for Shure-Set, the hammer-in fastening **tool,** are now available from Ramset Fastening System, Cleveland, Ohio.

(54) Leviton Manufacturing Company, Brooklyn, N. Y., has introduced a new line of **wall plates** in a complete range of 1-, 2-, 3- and 4-gang plates with combinations to meet all wiring installations. . . . (55) The Laging-Schultz Company, Mountain Lake, Minn., has announced a new periscope **flashlight,** called Peri-Light making it possible to see around stationary objects, between walls and into small openings. . . . (56) Supro Lux Manufacturing Co., Bronx, N. Y., has developed a new lamp size—T 12 84-in. slimline **fluorescent lamp,** 64 watts standard cool white and daylight.

(57) A 9% increase in the light output of its 40-watt standard cool white **fluorescent lamp** has been announced by the General Electric Large Lamp Department, Cleveland, Ohio. . . . (58) A new line of general purpose, sealed, nickel cadmium **batteries** is being marketed by the Alkaline Battery Division, Gulton Industries, Inc., Metuchen, N. J.

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CALIFORNIA
San Francisco: California Elec. Sup. Co.
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New Haven: Grand Light & Sup. Co.
New London: United Elec. Sup. Co.
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Englewood Elec. Sup. Co.
Hawkins Electric
Hyland Elec. Sup. Co.
Wholesale Elec. Sup.
Elgin: Fox Elec. Sup.
Rockford: Englewood Elec. Sup. Co.
Springfield: Springfield Elec. Sup.
INDIANA
Ft. Wayne: Mossman-Yarnelle Co.
Gary: Englewood Elec. Sup. Co.
So. Bend: Englewood Elec. Sup. Co.
IOWA
Des Moines: Weston Lighting Co.
KANSAS
Kansas City: W. T. Foley Elec. Co.
KENTUCKY
Paducah: Ohio Valley Sup.
LOUISIANA
Baton Rouge: Electrical Wholesalers
New Orleans: Interstate Elec. Co.
MAINE
Bangor: Standard Elec. Co.
MARYLAND
Baltimore: Atlantic Illuminating Co.
MASSACHUSETTS
Boston: Mass. Gas & Elec. Light Co.
Henry L. Wolfers Inc.
Fitchburg: Service Elec. Sup. Co.
Pittsfield: Carr Supply
Springfield: Eastern Elec. Sup.
Worcester: Atlantic Elec. Sup.
Benjamin Elec. Sup.
MICHIGAN
Detroit: Madison Elec. Co.
Michigan Chandelier Co.
Flint: Royalite Co.
Grand Rapids: Purchase Elec. Sup. Co.
Pontiac: Standard Elec. Co.
Saginaw: Standard Elec.
MINNESOTA
Duluth: Northern Elec. Sup. Co.
Minneapolis: Charles A. Anderson & Co.
Northland Elec. Sup. Co.
St. Paul: Lax Elec. Co.
MISSOURI
St. Louis: M. K. Clark
NEBRASKA
Omaha: Electric Fix. & Sup. Co.
NEVADA
Reno: Western Elec. Dists. Co.
NEW HAMPSHIRE
Portsmouth: Mass. Gas & Elec. Light Co.
NEW JERSEY
Atlantic City: Franklin Elec. Sup. Co.
Camden: Camden Elec. Fix. Co.
NEW YORK
Albany: Havens Elec. Co. Inc
Binghamton: Freije Elec. Sup. Co.
Buffalo: Buffalo Incan. Light Co. Inc.
Niagara Falls: Hysen Sup. Co.
Poughkeepsie: Electra Sup. Co.
Rochester: Rowe Electric Sup. Co.
Syracuse: Superior Elec
NORTH CAROLINA
Charlotte: Independent Elec. Sup.
Durham: Noland Co.
Greensboro: Elec. Sup. & Equip. Co.
Kinston: Kinston Elec.
Winston-Salem: Noland Co.
OHIO
Akron: The Sacks Elec. Sup. Co.
Canton: The Electric Sales
Cincinnati: B. & B. Elec.
Cleveland: H. Leff Electric
Columbus: Elgee Elec. Co.
The Loeb Elec. Co.
Dayton: Martin Elec. Co.
Toledo: Gross Elec.
Youngstown: Mart Industries
OKLAHOMA
Tulsa: Lawson Elec. Co.
PENNSYLVANIA
Allentown: Coleman Elec. Co.
Erie: Kraus Elec. Co.
Harrisburg: Fluorescent Sup. Co.
Hazleton: Power Elec. Co. Inc.
New Castle: Midwestern Elec. Co.
Philadelphia: Ace Lighting Fix. Co.
Gold Seal Elec. Sup. Co.
Sylvan Elec. Fix. Co.
Pittsburgh: Allied Elec. Sup. Co.
Argo-Lite Studios
Doubleday-Hill Elec. Co.
Wally Elec. Sup. Co.
Reading: Coleman Elec. Co.
Scranton: Lewis & Reif
Wilkes-Barre: Anthracite Elec. Sup. Co.
RHODE ISLAND
Pawtucket: Major Elec. Sup. Co.
Providence: Leavitt Colson Co.
SOUTH CAROLINA
Anderson: Sullivan Hdwe. Co.
Columbia: Capitol Elec. Sup. Co.
Noland Co.
Greenville: Sullivan Hdwe. Co.
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Watertown: J. H. Larson Elec. Co.
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Johnson City: Noland Co.
Nashville: Nashville Elec. Sup. Co.
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Dallas: Rogers Elec. Sup.
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Houston: Marlin Associates
San Antonio: Southern Equip. Co.
VIRGINIA
Arlington-Rosslyn: Noland Co.
Lynchburg: Mid State Elec. Sup. Inc.
Norfolk: Noland Co.
Roanoke: Noland Co.
WEST VIRGINIA
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Virginian Electric Inc.
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Appleton: Moe Bros. Northern Co.
Eau Claire: W. H. Hobbs Sup. Co.
Milwaukee: Lappin Elec. Co.
Standard Elec. Sup.
WASHINGTON
Seattle: Seattle Lighting Fix. Co.
ALASKA—*Anchorage:* Northern Supply Co.
CANADA
Montreal: The Gray Elec. Co.
Toronto: Revere Elec. Dist.
Toronto Elec. Sup. Co.
HAWAII
Honolulu: Hawaiian Light. & Sup. Co.

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Answer: Your Lightolier distributor's factory-trained salesman. He makes the calls for you, sells the Lightolier quality story, helps make profitable sales for you.

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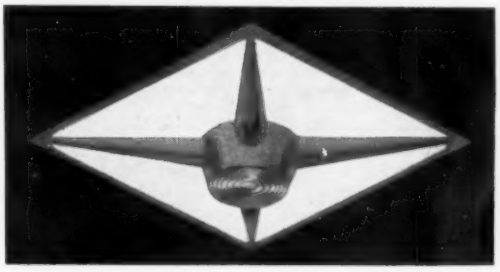

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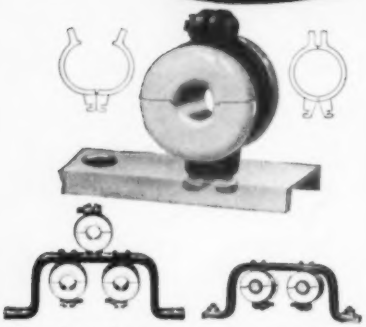

Nested conductor racks are compact and scientifically designed to carry cables equidistant from center to center. Available in 2, 3, 4, 5 and 6 bushing racks.

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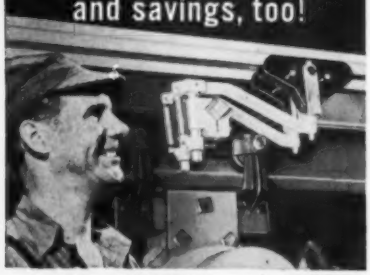

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Catalogs, Bulletins and Engineering Data

(59) ELECTRICAL CONDUIT of corrosion-resistant wrought iron. 8-page bulletin describes conduit's composition and processing and includes photos of installations, lists of suggested uses, and dimensional and weight data. National Electric Products Corp.

(60) MOTOR CONTROLS. 56-page catalog features tables giving horsepower, motor speed, heater size and heater ampere ratings plus enclosure choices and prices. Included also are design data and ordering instructions for magnetic starters and contactors, drum controllers, pressure switches, push buttons and other control and pilot devices. Furnas Electric Co.

(61) METAL FRAMING for surface metal raceway, fluorescent fixture mounting, and framing applications. 30-page catalog illustrates all channel sizes, fittings and accessories, together with complete specifications and application photos. Power-Strut, Inc.

(62) ADJUSTABLE SPEED DRIVE which operates from ac and connects directly to the load is described in 8-page bulletin 34-200. Electric Products Co.

(63) INDUSTRIAL LIGHTING FIXTURES. 4-page catalog shows new concept in low-cost high bay lighting using Power Groove lamps, gives installation data, detailed diagrams, and complete dimensions. Fluorescent Fixtures of California.

(64) WIRING DEVICES. New 76-page catalog illustrates over 1500 devices, lamps and specialty products, including such new items as bells, buzzers, transformers, wire connectors, receptacles and wire. Eagle Electric Mfg. Co., Inc.

(65) MILL REGULATOR for fail-safe regulation of line speed, voltage and tension for all continuous-process industries. Photos and copy shows how half of panel carries entire load in event of tube failure in other half. Reliance Electric and Engineering Co.

(66) SUPERVISORY CONTROL EQUIPMENT. Bulletin GEA-6603, 16 pages, describes functions ranging from opening and closing of switches and valves to adjustments of speed, voltage and load for application in industrial power distribution, electric utilities, petroleum industries, and others. General Electric Co.

(67) POWER REGULATORS. Complete redesign of single-phase, unit-type regulators, with photos, ratings and dimensions, is described in 16-page bulletin 21B-6065D. Allis-Chalmers Mfg. Co.

(68) ADJUSTABLE SPEED DRIVE, a variable-voltage dc drive that uses ac as its power source, is described in 12-page bulletin No. 2000. Ratings of from 5 to 200 hp find applications with machine tools, metal processing, textile, paper making and related processes. Louis Allis Co.

(69) ARCHITECTURAL LIGHTING equipment is summarized in new 32-page pocket catalog designed for contractors and distributors for use with customers and prospective customers, showing photos and interior sketches of actual installations. Lightolier, Inc.

(70) SEMI-CONDUCTOR RECTIFIER bulletin 12B8897 describes line of germanium, silicon and selenium rectifiers providing up to 95% conversion efficiency. Allis-Chalmers Mfg. Co.

(71) AIR CONDITIONING of multi-story buildings with packaged Multi-Weathermaker System is described in new brochure. Included are a survey of building total cooling needs, location of conditioning units, and sequence of emplacement. Weathermaker Dept., Carrier Corp.

(72) OUTDOOR LUMINAIRES for large-area lighting are listed in 4-page booklet. Ultra-Lite units provide horizontally square light pattern appropriate for shopping center plazas, parking areas, parks, drive-ins, or school or city playgrounds. Revere Electric Mfg. Co.

(73) DISTRIBUTION PANELBOARDS —new, heavy-duty fusible type incorporating quick-make and quick-break fusible switch units. 4-page bulletin GEC-1382A lists features, application data, horsepower ratings and dimensions. General Electric Co.

(74) WATERTIGHT FLOOR BOXES. New bulletin No. 4-A pictures all types of floor boxes with both angular and vertical leveling, with complete specifications and dimensions. 24 pages. Russell & Stoll Co., Inc.

(75) TOGGLE AND TRIGGER SWITCHES in ten standard types are listed, with illustrations, plus dimensional and electrical rating data. All are specifically designed for small motors, appliances and electronic equipment. Sargent Electric Corp.

(76) POTHEADS for single- and three-conductor cable sealing for indoor and outdoor service are treated in 12-page catalog. Delta-Star Electric Div., H. K. Porter Co., Inc.

(77) TRANSFORMERS for power applications, unit substations, secondary networks, furnaces and instrument applications are designed and illustrated in 20-page bulletin 61B6186C. Allis-Chalmers Mfg. Co.

(78) ANTI-OXIDANT COMPOUND for making trouble-free electrical joints. Bulletin HV10-305, 2 pages, gives application and technical data. Hi-Voltage Equipment Co.

(79) SECONDARY CAPACITORS for 240-volt residential systems. Bulletin GEA-6670, 8 pages, discusses applications, engineering features, simplified installation and maintenance. General Electric Co.

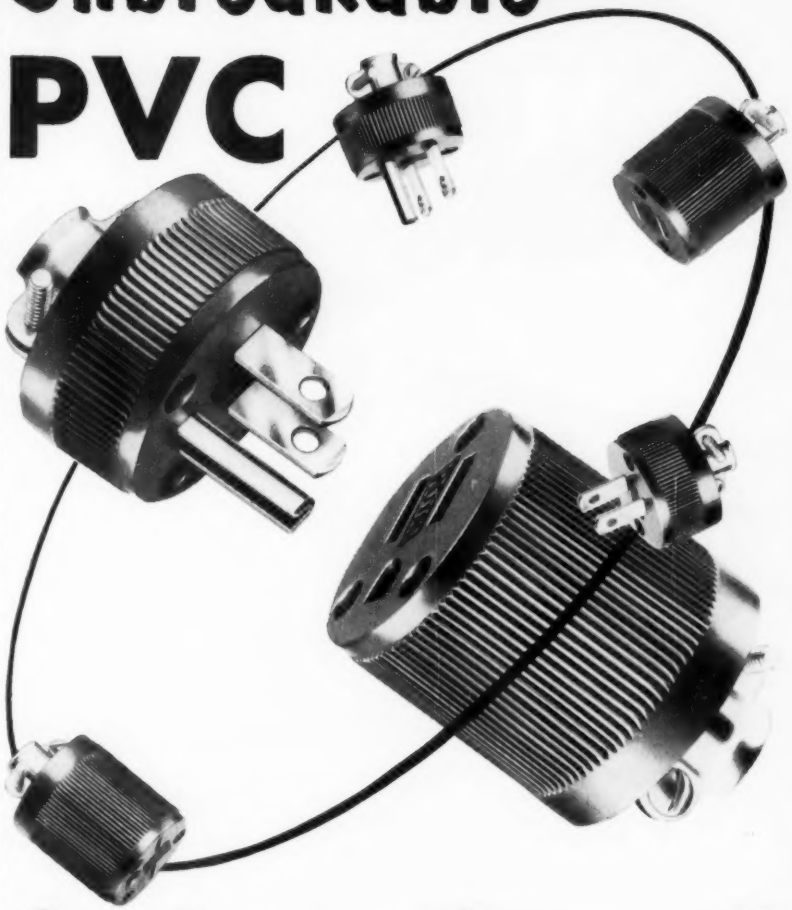
(80) FLUORESCENT LAMP BALLASTS. New data book contains information on ballast circuits, ballast construction, supply voltage and frequency, radio interference, and ventilation and cold weather operation. Advance Transformer Co.

(81) CONDUIT FITTINGS of aluminum. "Red Dot" line of conduit bodies is described in new catalog, with complete range of styles and sizes in both threaded and set screw types. L. E. Mason Co.

(82) FLUORESCENT LAMP BALLASTS. 16-page brochure highlights benefits provided by CBM specification to all concerned with fluorescent lighting. Certified Ballast Manufacturers.

(83) WEATHER-PROTECTED MOTORS with enclosures built to meet every requirement of outdoor service. Two bulletins include construction and mechanical features for commonly used ratings, horizontal and vertical, 250 hp and above, and 505 to 900 hp. Allis-Chalmers Mfg. Co.

Unbreakable PVC



Outlasts them all

Make up your extensions and power supply cords with ROYAL PVC Heavy Duty Grip Caps and Connectors—the all-vinyl molded devices, with blades and contacts locked in solid vinyl— built to take punishment and come back for more.

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- **Tops for every service.** Give PVC devices a real beating — expose them to oil, grease, acid — no other devices can match their performance and durability.

Order PVC from your wholesaler, today. Or, write for Catalog 2-3-57 and a free sample, giving us your wholesaler's name. **Royal Electric Corporation, Pawtucket, R. I.**

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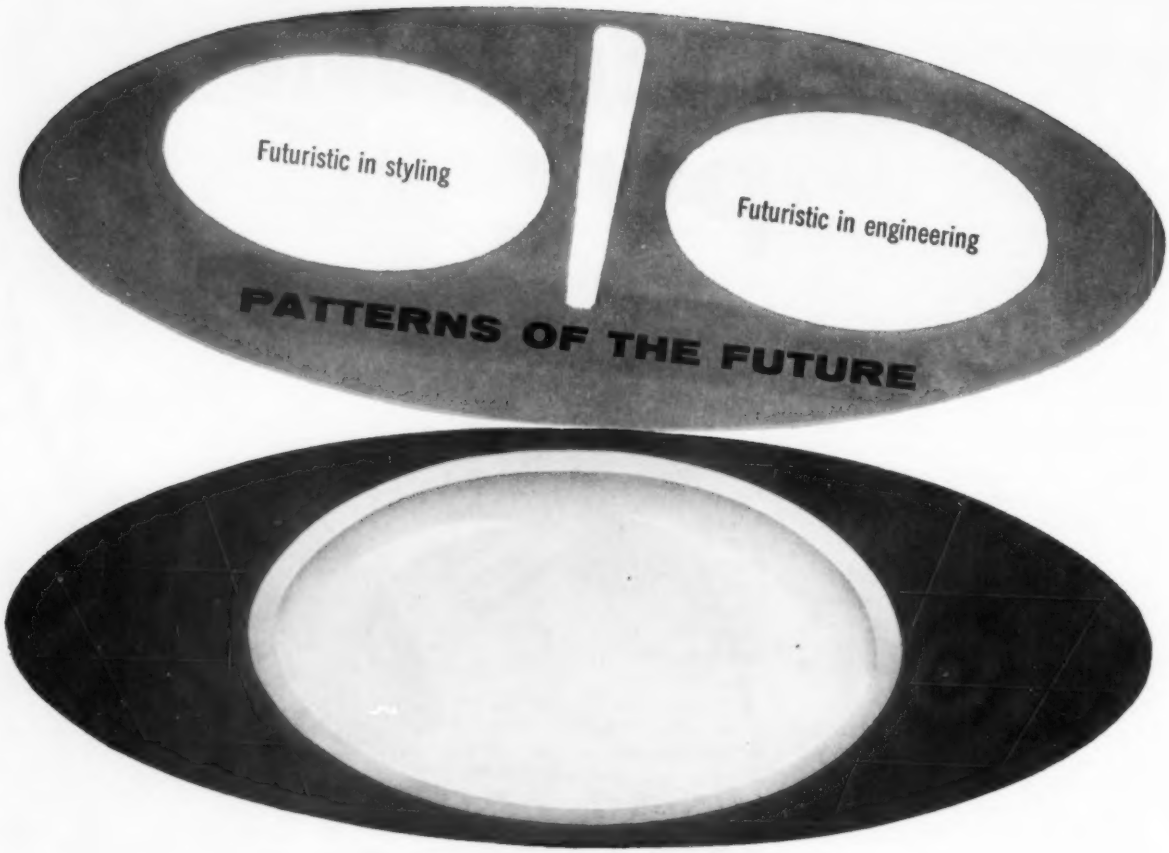

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these handsome "large area," recessed, 4-foot in diameter, circular Visionaires: the SP3840 series. Besides widening the architectural-designer's range of dramatic concepts in interior designs, the SP3840 is ideal either as a contrast fixture or the dominant shape in the ceiling theme. Matte-finish translucent white Plexiglas affords distinctive illumination: unusual low brightness, minimum glare and greater visual comfort. Diffusers are concave for added strength and structural stability. Fixture-body is square for easy installation. Loosening of only 4 screws permits fully framed diffuser to be lowered on concealed slotted hinges for relamping without removal. Bonderite treated against corrosion and finished in high reflectance, all white baked enamel. Also available 24" and 36" in diameter. Write for bulletin D-49.

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Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Interrupting Capacity Of Breakers and Fuses

QUESTION E33—I heard two engineers discussing the I.C. of circuit breakers and high voltage fuses; one said it depends only on the available short circuit current of transformers; the other said it also depends on where on the system you are to add circuit breakers or fuses. He also said that as you go down the line of interruptors, each consecutive one may be smaller and compared it to walking down a stairway. Which of the above engineers is right and why?—M.D.

ANSWER TO E33—M.D.'s two engineers discussing the I.C. of circuit breakers and high voltage fuses were both partly right and neither entirely so. The required IC depends on the available short circuit current AT THE POINT OF SHORT CIRCUIT. The one or more lines feeding to a possible short circuit must be disconnected by CBs or fuses next in line toward the source or sources of power supply. Impedance of the lines will tend to reduce the magnitude of the short circuit current, hence engineer No. 2 is right if he qualifies his statement to apply only to lighting or heating circuits which have no motors. Synchronous motors act as generators for a short time after the short circuit occurs. Induction motors do likewise for a shorter time, but they need be considered only where the circuit is opened by air circuit breakers or fast-acting fuses.

General Electric's bulletin GET 1470D gives a good explanation. Allis-Chalmers & ITE also give good stories.—R.W.K.

ANSWER TO E33—The second of two engineers discussing I.C. of circuit breakers was closer to the facts. What he evidently had in mind were the two methods of application of low voltage breakers; cascading and selective tripping.

Cascading is a method of using lower I.C. breakers on a circuit by following a definite set of established rules. These are as follows:

(1) The maximum number of cascading steps is three.

(2) Assuming the three steps involve a transformer secondary breaker, a feeder breaker and branch breaker:

a. The transformer secondary breaker can be applied up to 100% of its rated I.C.

b. The feeder breaker can be applied up to 200% of its I.C.

c. The branch circuit breaker can be applied up to 300% of its I.C.

(3) The instantaneous short circuit trip valves must be set so that the back-up breaker trips are set at values not exceeding 80% of the interrupting rating of the breaker being protected.

Selective tripping is the operation of circuit breakers in series so that only the breaker nearest the fault operates and breakers nearest the source remain closed.

Principal requirements are:

1) Each circuit breaker must have an interrupting rating equal to or greater than the available short circuit current at the point of application.

2) The time-current characteristics of each air circuit breaker at all values of available overcurrent shall be such as to insure that only the breaker nearest the fault function to remove the fault condition.

3) The time-current characteristics of the backup breakers must not overlap. The pick-up setting and time delay bands of both the long and short time delay elements must be properly selected.

It should be pointed out that selective tripping is inherently more protective than cascading. With cascading, all breakers will trip resulting in a complete shutdown should the fault current exceed the instantaneous trip setting of the backup breakers. With selective tripping only the breaker on the faulted circuit would operate. Cascading is justifiable where there are a large number of feeder circuits of relatively low ampere capacity and it is not vital for the remainder of the system to operate when a fault occurs on feeder.—J.C.

Transformers

QUESTION F33—In our plant, we have three 50-kva, 440/110-volt transformers connected 3-phase delta-delta. For nine hours they carry a 10% overload, for six hours they carry 60% full load, and for the balance of the 24 hours the load fluctuates between 60% and full load. The 24-hour rms value of this current is about 94% of full load. Is it safe to operate these transformers at the above load? If not, what is an economical solution to the problem.—J.M.

ANSWER TO F33—This depends on the cooling conditions. If the conditions are perfect then a 150% constant overload is O.K. If conditions are very bad, then the charging current with a 5% load will burn out the transformer. In order to help the transformers during hot weather, bring the power factor up to 90% by using capacitors, and if that will not bring the amps down, then I would get three more 25 or 50 kva transformers to carry part of the load.—H.S.

ANSWER TO F33—I would consider this installation safe. Distribution transformers are built to carry considerable overloads without damage to themselves. A 10% overload for only a part of each 24-hour period would not justify replacement.—W.R.S.

ANSWER TO F33 — Your best method of checking safe operating conditions would be to compare the transformer's actual temperature against nameplate rating. Most transformers allow 55° C rise above ambient, ambient being considered as 40° C (104° F).—H.R.W.

3-Phase vs Single Phase Motors

QUESTION G33—If 3-phase and single phase service is available, is it cheaper to operate 3-phase motors instead of single phase motors? What is the comparative cost of operation based on same horsepower ratings?—G.J.P.

ANSWER TO G33—As I see it the greatest savings in 3-phase as opposed to single phase is in installation cost. As watts are the billing factor, higher voltage will not change this. Power factors of 3-phase motors are generally better

The "Man on the Ladder"

the complete line that offers

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ELECTROLET KILLARK SPEEDOLET

Vandeventer and Easton Aves. **St. Louis 13, Missouri**

talks about KILLARK fixtures

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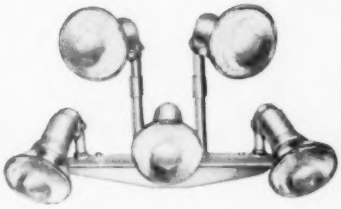
PEAK EFFICIENCY...MODERN DESIGN



FOR HAZARDOUS LOCATIONS, from my experience, Killark Fixtures offer the ultimate for both my client and myself in dependable protection, better lighting and easier maintenance. Take this Explosion-Proof Fixture shown here, for example. You can see from the design how easy it is to relamp without tools. Wattage can be quickly changed on the spot, too, by a simple replacement of the adaptor. Snug-fitting, air-cooled aluminum body and shock-proof globe all mean on-the-job safety at all times.

FOR MY CLIENTS WHO WANT CLEAR, BRIGHT, CONTROLLED LIGHT, as for loading-dock or yard areas, I always suggest Killark Cluster-Lites. Their sealed Beam Lamps are adjustable in any direction, completely weatherproof, no reflectors to service. Rustproof aluminum offers years of uninterrupted service.

FOR "BEAUTY SPOT" AND HIGH-POWERED FLOOD LIGHTING, Killark also offers a complete selection of spotlights. They offer a powerful, compact source of light: flexible aiming, easy maintenance, minimum cleaning. The rustproof, non-staining aluminum design also assures cool operation for longer lamp life.

THE COMPLETE LINE OF KILLARK DUST-TIGHT FIXTURES boasts a graceful "ledge-free" design that prevents the dangerous accumulation of dust particles. Close-fitting lamp parts, carefully machined and skillfully assembled, positively exclude dust. Killark makes a complete series in ceiling, bracket and pendant styles.

THE KILLARK CONCH LIGHT is further proof that Killark brings you complete selection under one name. Here is subdued lighting at its dramatic best—attractively styled in gleaming, never-dulling aluminum and very effective for doorways, corridors and outdoor theatres.

VAPOR-TIGHT FIXTURES BY KILLARK are not only vapor-proofed inside but weather-proofed outside. They are made of never-rusting, non-corroding Alumalloy, a special Killark aluminum alloy. I know they can take any kind of climate or humidity, because I've installed them on docks, in railroad yards, underpasses and bridges and indoors in cold storage plants, breweries and dairies. They come large or small, too: from 60w to 500w sizes.

THIS NEW DEKORATIVE LIGHT is a handsome combination of weather-proofed lighting, plus sleek, streamlined beauty. It's tastefully styled in non-rusting, non-corroding Alumalloy (an exclusive with Killark) so that it's attractive for inside use, practical for outdoor use.

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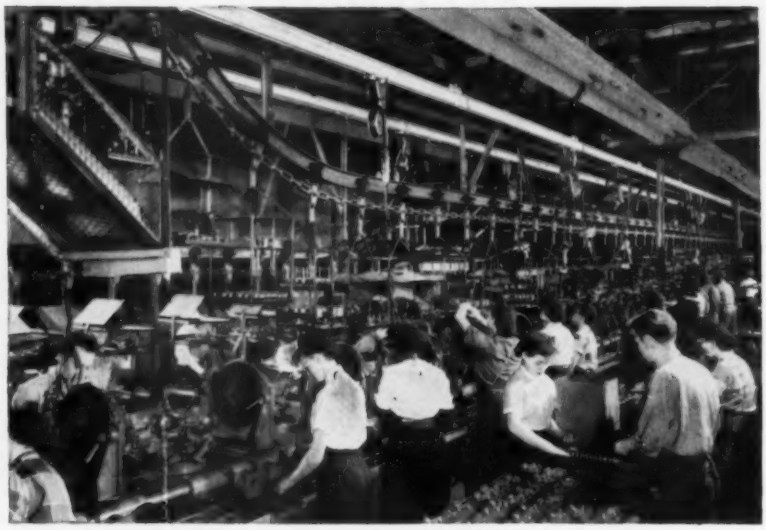
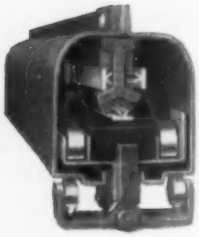
keeps production on the move



...because it moves with production



Feedrail systems (60 to 500 amperes) keep production moving throughout industry — provide convenient movable power sources for:

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- Conveyor Assembly Lines
- Moving Test Lines
- Portable Tools
- Machine Tools
- Cutting and Sewing Rooms
- Lighting
- Motor Control
- Business Machines

Eliminate the dangerous, time-wasting "cable clutter" of old-fashioned production lines – and you've gone a long way to speeding up production.

Feedrail "moving power systems" do this by feeding power to portable tools and other electrical equipment through *overhead mobile outlets.*

Power is available instantly anywhere along the line. Long, dragging cables that hamper production are eliminated. Employees can move about in complete safety.

Result: *faster, safer production.*

An added plus is that Feedrail never becomes obsolete. If production requirements change, Feedrail can be relocated or extended with surprising ease and speed.

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than single phase. But operating cost will still be the same although generally 3-phase is the preferred installation.—R.W.R.

ANSWER TO G33—The energy cost of operating a single phase motor will be greater than that of a 3-phase motor of the same horsepower. The volt-ampere input of the single phase motor will be higher due to larger inherent losses caused by greater I^2R and reactive volt-ampere losses. With the larger losses for the single phase machine, its efficiency is therefore lower. The single phase motor will be larger and heavier than the 3-phase motor due to the extra wire it requires. However, due to volume production of single phase motors, they usually cost less. But maintenance costs will usually prove to be less for the 3-phase motor.—H.B.A.

How to Identify Lead Numbers

QUESTION H33—How is it possible to determine the lead numbers on a 3-phase, 9-lead motor after all lead numbers are destroyed or cut off? Circuits can be lamped but how could the numbering be determined?—E.S.H.

ANSWER TO H33—Determination for replacement of lost or misplaced lead numbers on a dual-voltage 9-lead Star-connected 3-phase motor can be done with a 3-volt dry cell battery and a 0-1 milliampere meter by the following method:

Use a test light to locate and tie in groups the leads of the four groups of the winding. One group will contain three leads. Three groups will contain two leads each.

Place numbers 7, 8 and 9 in any order on the three leads of the 3-lead group.

The following test should then be made: (An asterisk (*) before a number indicates that number is connected to the positive terminal of the battery or meter.)

Connect the battery to *7 and 9. Test the three remaining groups for kick of the meter hand when the battery circuit is made. In every case arrange the meter so the kick will be up-scale. The group showing no, or least, kick is 2-5 and should be so numbered irrespective of polarity. Connect battery to *8 and 9 and the group showing no, or least, kick is 1-4 and should be so numbered. The remaining group is 3-6, and should be so numbered.

To establish proper polarity of

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the three 2-lead groups connect the battery across *7-8 or *7-9, which ever gives a readable kick when the meter is connected across 1-4 group. Arrange 1 and 4 on the meter to get an up-scale kick. The lead connected to the positive terminal of the meter is No. 1 and the other lead is No. 4 and should be so numbered.

Connect 7-9* or 8-9* to the battery. Connect 3-6 to the meter in such a way as to get an up-scale kick. The lead on the positive terminal of the meter will be No. 3 and the lead on the negative is No. 6.

Connect *8-9 or 7-8* to the battery, and 2-5 to the meter for an up-scale kick. No. 2 will be connected to the positive terminal and No. 5 to the negative.

In brief the three 2-lead groups should be as follows:

With battery across:	Check these leads:
*7-8 or *7-9	*1-4
7-9* or 8-9*	*3-6
8-9 or 7-8	*2-5

A test for dual voltage delta windings is given in "Electrical Testing and Troubleshooting."—Green, Published by Industrial Press.—J.A.

ANSWER TO H33—I assume that the nine-lead motor in question is dual voltage and is Y connected. First ring out or light out the leads. It will be found in a Y connected dual voltage motor that there are three groups of two wires each, and one group of three wires that will show continuity. The single group of three wires lead to the part of the winding that is connected by the internal Y. These three wires may be numbered T-7, T-8, and T-9. The three groups of two wires are tentatively marked T-1 and T-4, T-2 and T-5, and T-3 and T-6 indiscriminately.

A source of power equal to the low voltage connection of the motor should be found and the line leads identified by marking them L-1, L-2, and L-3. The three wires of the motor marked T-7, T-8, and T-9 are connected to L-1, L-2, and L-3; L-1 to T-7, L-2 to T-8, and L-3 to T-9. Turn power on and observe direction of rotation. Turn off power and disconnect leads T-7, T-8, and T-9.

Tie leads T-4, T-5, and T-6 together to make external Y connection and connect leads T-1, T-2, and T-3 to L-1, L-2, and L-3 respectively. Apply power as in above paragraph and compare direction of rotation with that found in previous test. Direction of rotation should be the same.

If motor will not run with this connection, it will be necessary to interchange the connection of one group and relabel the group. For example interchange T-2 and T-5 so that we now have leads T-4, T-2, and T-6 tied together and T-1, T-5, and T-3 connected to L-1, L-2, and L-3 respectively. If motor runs, relabel group T-2 and T-5 so that T-2 becomes T-5 and T-5 becomes T-2. If the motor still does not run another group should be interchanged until a combination is found that will run, and then relabel.

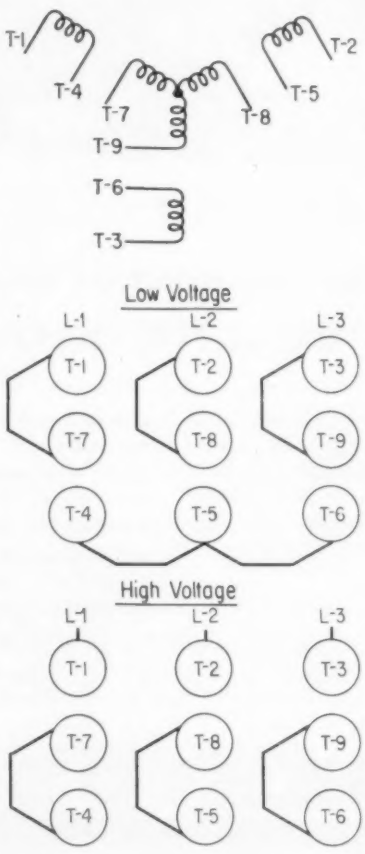
If rotation is not the same, interchange any pair of leads connected to line leads and relabel group to correspond. For example; leads T-1 and T-2 were interchanged and are now connected as follows:

Lead T-1 to L-2 and lead T-2 to L-1. Relabeling, lead T-1 becomes lead T-2, lead T-4 becomes lead T-5, lead T-2 becomes T-1, lead T-5 becomes T-4.

Disconnect leads T-1, T-2, and T-3 and reconnect leads T-7, T-8, and T-9 to L-1, L-2, and L-3 respectively and energize. With a volt meter of suitable scale check for lowest voltage reading between L-1; T-7 and leads T-1, T-2, and T-3. Do the same for L-2: T-8 and L-3: T-9. Where a low reading is found, that lead is connected to the line with which the reading was obtained and relabeling of leads T-1 and T-4, T-2 and T-5, and T-3 and T-6 can be done permanently. For example, say that a low reading was obtained between L-1:T-7 and lead T-3, L-2: T-8 and lead T-1, and L-3: T-9 and lead T-2. This means that leads T-3 and T-6 become T-1 and T-4, leads T-1 and T-4 become T-2 and T-5, and leads T-2 and T-5 become T-3 and T-6.

In the event that no low-voltage reading is obtained, it will be necessary to connect T-1, T-2, and T-3 leads together and open T-4, T-5, and T-6 leads and then relabel them. For example, lead T-1 becomes T-4, lead T-2 becomes T-5, lead T-3 becomes T-6, lead T-4 becomes T-1, lead T-5 becomes T-2, and lead T-6 becomes T-3. Proceed again as in previous paragraph.

This will give a motor with its windings labeled as in the diagram below.—E.M.G.



Calculating Ohms Of Resistance

QUESTION J33—How do you calculate the ohms of resistance for a field rheostat for dc speed adjustment?—J.R.

ANSWER TO J33—The speed of dc motor is inversely proportional to the strength of the field magnetic flux. This flux is changed by varying the shunt-field current and this is accomplished by a field rheostat. Speed ratios as high as 5:1 are obtainable with motors that have commutating poles, but for motors without commutation poles, speed ratios should not exceed 2:1 as severe sparking will occur at the brushes. Keep in mind that fluctuating loads can result in instability at speed ratios above 2.5: 1. Therefore, in general, do not exceed this speed.

Now, to calculate the resistance of a field rheostat, measure the field resistance and use a rheostat whose resistance does not exceed this value by 250%. This will suffice in most cases, but check with the motor manufacturer in any critical installation.—J.M.

ANSWER TO J33—It is possible to determine the resistance necessary for control of a dc motor by

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D.C. **A.C.**

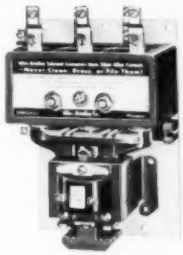
RELAYS AND CONTACTORS

Bulletin 200, Type G Relay. Rated: 5 amp, 64 v; 2 amp, 125 v; 0.5 amp, 250 v.

Bulletin 202 Contactor, Size 2, 1 Pole. Rated: 50 amp, 115-230 v.

D.C. relays are made with up to 8 poles. Also universal types, having contacts changeable from N.O. to N.C.—or vice versa—by merely reconnecting the terminals. Up to and including the 150 ampere rating, D.C. contactors are of the solenoid type; beyond this rating, up to and including 600 amperes, the clapper type construction is used.

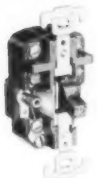
Bulletin 700, Type C. Rated: 10 amp, 550 v max.



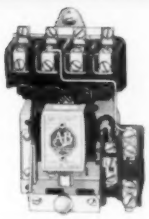
Bulletin 702, Size 2, 3 Pole. Rated: 50 amp, 550 v max.

A.C. relays are made in different types for various applications, with up to 8 poles. The universal type, having contacts changeable from N.O. to N.C.—or vice versa—is very popular. The A.C. solenoid contactors, made in 9 ratings up to 900 amp, 550 v max., will satisfy any service requirement. Silver alloy contacts are used throughout the D.C.-A.C. solenoid relay and contactor lines.

ACROSS-THE-LINE STARTERS



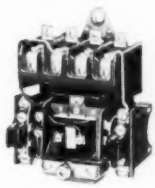
Bulletin 600, Form 52, double pole only, open type. Max rating: ¾ hp, 115-230 v.



Bulletin 209, Form 2. Max rating: 1½ hp, 115 v; 2 hp, 230 v.

D.C. manual starters have a rugged, snap action mechanism that prevents contact "teasing" and thus prolongs contact life. D.C. manual and solenoid starters have maintenance free, double break, silver alloy contacts. Motor overload protection is reliable.

Bulletin 600 in general purpose enclosure, complete with reliable overload breaker. Rated: 1 hp, 110-220 v.



Bulletin 709, Size 1. Rated: 7½ hp, 220 v; 10 hp, 440-550 v. Same general construction for max ratings of 300 hp, 220 v; 600 hp, 440-550 v.

All Allen-Bradley A.C. motor control is equipped with silver alloy contacts which are always in good operating condition. Because all A-B solenoid starters have only one moving part, trouble free performance and long life are automatically assured. It is the basic reason for Allen-Bradley's "quality" reputation.

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2-58-M

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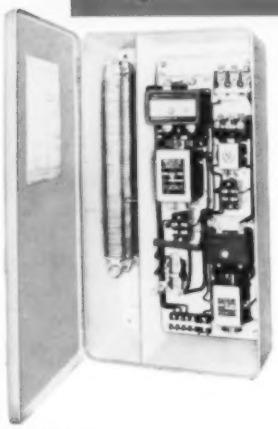
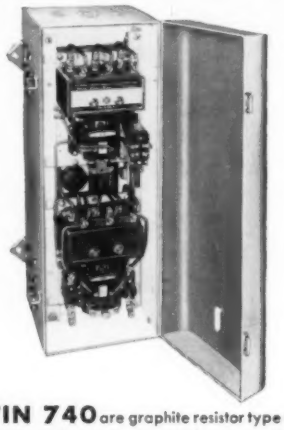
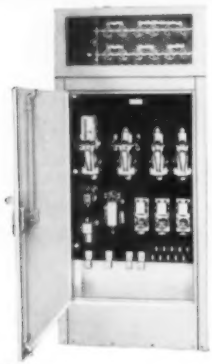


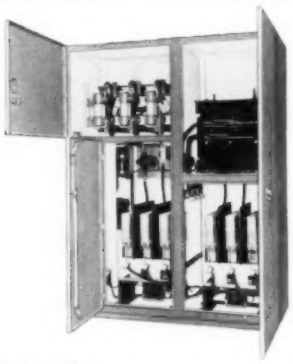
BULLETIN 267 are time limit, resistor type starters for automatic acceleration of constant speed shunt and compound wound D.C. motors. Solenoid contactors used up to and including Size 4 ratings. Max ratings: 75 hp, 115 v; 150 hp, 230 v.



BULLETIN 740 are graphite resistor type starters for automatic acceleration of squirrel cage A.C. motors. Made with 1 or 2 points of acceleration. Can provide velvet smooth acceleration for squirrel cage motors. Max ratings: 200 hp, 220-440-550 v.



BULLETIN 268 are time limit resistor type starters for automatic acceleration of adjustable speed shunt and compound wound D.C. motors. Designed for heavy duty service. Both Bulletin 267 and 268 starters available with or without dynamic braking feature, and also for reversing service. Max ratings: 75 hp, 115 v; 150 hp, 230 v.



BULLETIN 983 high tension starter illustrated above is of the reactor type, intended for starting synchronous motors. Available as an autotransformer reduced voltage starter; also in the across-the line construction. The heavy duty, solenoid air break contactor assures long, trouble free life. Max ratings: 1500 hp, 2300 v; 2500 hp, 4600 v. at 0.8 P.F.

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2-58-M

field rheostat by simply taking and reducing the field current inversely as the speed. For example: if double the speed is required then one half the field current will do it approximately. This method is not too accurate due to the hysteresis curve, the increase in friction and windage, etc.

If accurate control is necessary then it would be best to obtain a speed versus field current curve of the motor either by running a test yourself or from the manufacturer. Knowing the speed at a given field current then by use of Ohms Law the proper resistance can be obtained.

Care must be exercised not to weaken the field to the extent that armature reaction will further weaken the field and cause the motor to run away. Also the neutral plane of the brushes must be shifted opposite to the direction of rotation of the armature in order to prevent severe sparking at the commutator. Where speed range will vary considerably, machines having commutating or interpoles should be used —E.M.G.

Fusing a 7½-Hp Motor

QUESTION K33 — How can one properly fuse a 7½-hp motor? Some codes insist that a 60-amp motor switch must be used although the 7½ hp, 3-phase, 220-volt motor needs not more than a 25-amp fusetron.— H.S.

ANSWER TO K33 — To properly fuse a 7½ hp, 3-phase motor connected 220-volt, the code requires a 60-amp disconnect switch, due to starting, and locked rotor current. This does not mean you have to use 60-amp fuses. You may use any from 35-amp up to and including 60-amp, depending upon the starting load current. This type of fusing will not protect a motor from overcurrent or burn out.

Protecting a motor by fusing, use a fusetron of the motor rating. This type of fuse will carry the starting load current, for a safe period of time, but will blow in case of a direct short, overload, or single phase. The fuse will carry the rated current continuous until an overcurrent occurs. To use a 22-amp fusetron for this 7½-hp motor, a fuse reducer from 60- to 30-amp will be necessary.—L.R.S.

ANSWER TO K33 — To properly evaluate this problem another factor must be known and that is the code classification of the motor. All motors cannot be fused at 25 amps although they are 7½ hp. A complete listing of fuse variations is given on page 1683 of the "American Electricians Handbook", by Croft, along with explanation of table on preceding pages.

However due to latest J.I.C. & NEMA standards switches are now rated in horsepower and this then is the switch to use and fuse motor according to code of motor. The majority of motors will fall into the class mentioned so that 30-amp fuses would be sufficient. However, if a larger disconnect must be used the fuse clips should be only as large as needed. Thus you could put 30-amp clips in a 60-amp switch although this seems unnecessary with switches now available.—R.W.R.

Can You Answer These QUESTIONS

QUESTION V33—In our plant we have need for what is called extremely blue clear north sky light to properly inspect our product for true color. Our inspection area is lighted with 100 4-tube fluorescent fixtures. Since the cost of special fixtures and installation cannot be justified at this time, I would like to know if there are any special filters or special lamps that can be used to serve the purpose.—J.M.

QUESTION W33—In the plant where I am employed we have dc magnetic brake coils to test, power being supplied from a 6-volt dc generator.

In trying to regulate the voltage to supply the current for which the coil is designed, it is necessary to lower the voltage to about 2 volts. When this is done the ammeter needle is very unstable, making it impossible to obtain a proper ampere reading. Can someone describe the cause of this instability of the meter needle and suggest a remedy? —B.A.S.

QUESTION X33—It is claimed that the amplidyne eliminates short circuits and has practically no resistance in comparison with other motors of the same size. How is this done? Can the amplidyne be made to generate power by supplying mechanical energy to it?—E.B.

QUESTION Y33—What is an easy way to dry ignition transformers after a flood?—H.S.

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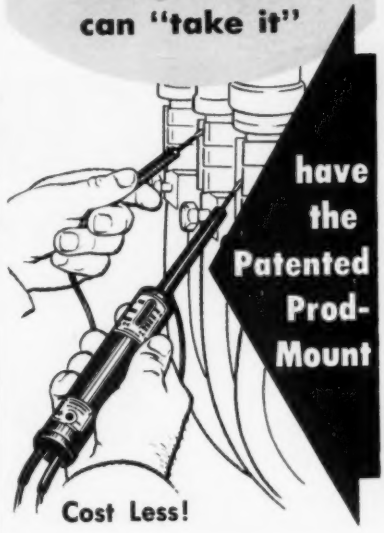

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Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

3-Phase—Delta Loading

Q. *Six 25-amp, 480-volt single phase heating units are to be installed at switches in a railroad yard to prevent freezing. Does the code recognize the connection of these six heating units to one 3-phase, 3-wire delta branch circuit? If not, how many circuits are required and how would you compute the size of the branch circuits and the feeder serving such a load.—R.O.*

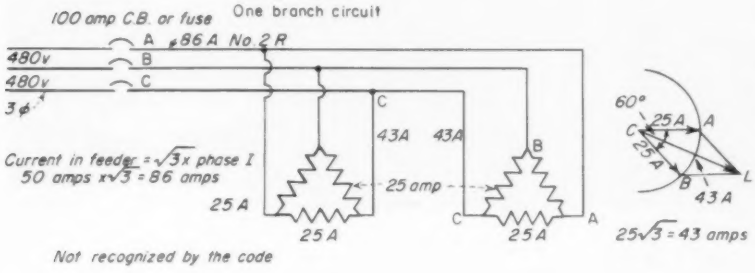
A. According to the provisions of Section 2126 of the code, it appears to me that each one of the six, 25-amp heaters must be served by a 30-amp branch circuit. Fig. No. 1 illustrates the situation which results when all of the heaters are connected to one 3-phase branch circuit. In the interests of clarity we have connected three of these heaters over the three phases similar to the connection for a 3-phase delta motor. There is a current of 25 amps in each phase, but the current in the line is the vector sum of the phase currents, and when the phase currents are equal it amounts to the square root of three, times the phase current. As a result, the line current for three-25-amp heaters is 43 amps, and when three more heaters are connected over the three phases the line current will be 86 amps. Section 2103 and 2126 of the code does not recognize a branch circuit of this size and we definitely have a code violation when we install the six heaters on one branch circuit.

If we connect three heaters to each of two branch circuits, as shown by Fig. No. 2, 50-amp branch circuits would be required. Section 2126-c however does not recognize the connection of such types of appliances to a 50-amp circuit. As a result we could not use such circuits without a code violation.

In view of the foregoing the only method recognized by the code is to install six individual branch circuits as shown by Fig. No. 3. The feeder current in this case is also 86 amps. Computations shown on the illustrations.

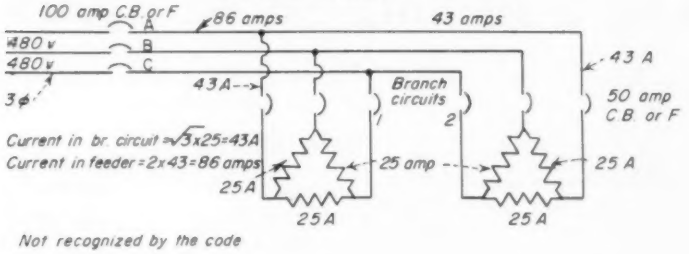
While the above comment is based on code rules, it is significant to note under the introduction to the code, that the rules are not intended to apply to a railroad utility in the exercise of its function as a utility, especially when the installation is located outdoors. It has been my experience however that the design engineers responsible for railroad electrical installations specify an installation far in excess of code rules. They realize the importance of the various functions involved and specify accordingly.—B.A.McD.

Fig. No. 1
One branch circuit



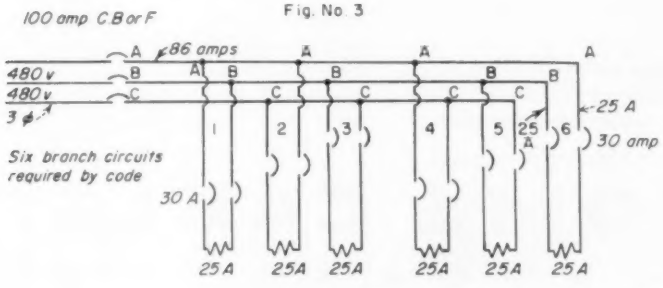
Not recognized by the code

Fig. No. 2
Two branch circuits



Not recognized by the code

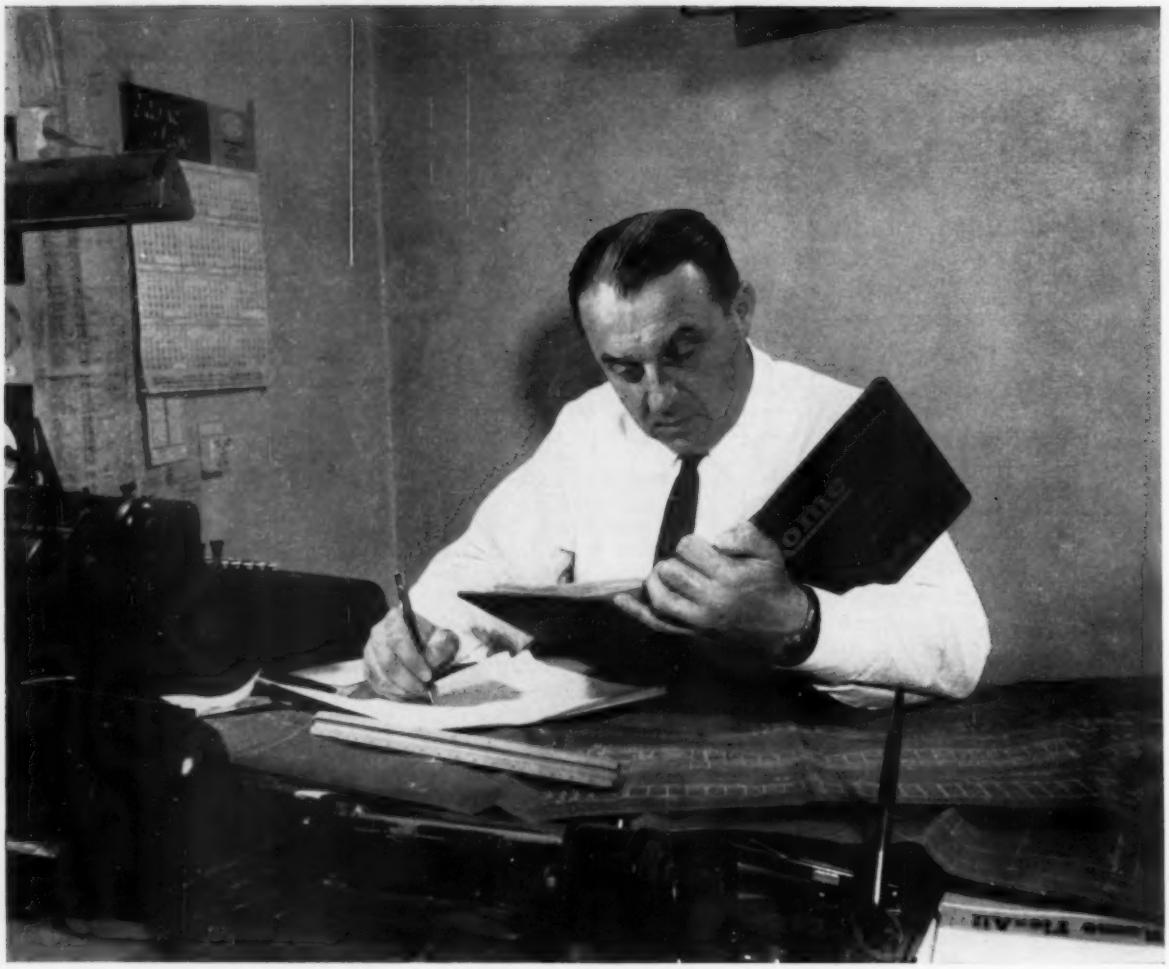
Fig. No. 3



Panelboard

Q. *We are in the process of designing a specially shaped cabinet to be used as a panelboard beneath a continuous row window to house 12 circuit breakers for lighting circuits and two 3-pole breakers for power circuits. Due to the design of the building, it is necessary that this panel be not more than 14 in. high so we plan to build it as a wiring trough mounting the breakers at the top of the trough leaving ample room in the bottom to be used as wiring space. Now we understand that this wiring space must be enclosed within the cabinet. Is this true?—P.S.G.*

A. It will depend entirely as to how the conductors are taken from the box as to whether or not a wiring space is required. Under



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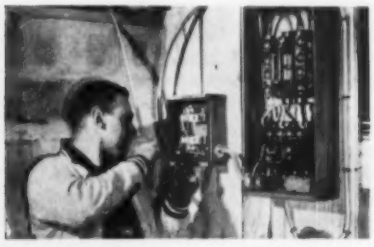
To meet today's highly competitive conditions, you can trim as much as 15% from your bids for 100-amp service jobs —where voltage drop is no problem.

Using Rome's SE Style U service entrance cable, you can substitute No. 3 AWG copper conductors for the more expensive No. 2 AWG. This money-saving substitution is possible because Rome's SE cable has UL approval for 75 C operation in either wet or dry locations. A reinforced rubber moisture seal under the weather-resistant braid gives Rome's SE cable its own built-in "dry location."



Installation ease Rome's SE cable can be installed in a hurry. Conductors are easy to identify; and the cable is always easy to handle because it resists becoming tacky, even under severe storage conditions.

Neat appearance The neutral-gray weatherproof finish will readily blend with the outside color schemes of most houses, and can easily be painted when necessary.

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Section 93732, paragraph c., you will note the following:

"Cabinets and cutout boxes which contain devices or apparatus connected within the cabinet or box to more than eight conductors, including those of branch circuits, meter loops, sub-feeder circuits, power circuits and similar circuits, but not including the supply circuit or a continuation thereof, shall have back wiring spaces or one or more side wiring spaces, side gutters or wiring compartments."

Then under paragraph d. you will also note:

"Side wiring spaces, side gutters or side wiring compartments of cabinets and cutout boxes shall be rendered tight enclosures by means of covers, barriers or partitions extending from the bases of the devices, contained in the cabinet, to the door, frame, or sides of the cabinet; provided, however, that where the enclosure contains only those conductors which are led from the cabinet at points directly opposite their terminal connections to devices within the cabinet, such covers, barriers, or partitions may be omitted."

And the last sentence of this paragraph reads as follows:

"Wiring spaces that are required by paragraph c. of this section and which are exposed when doors are open, shall be provided with covers to complete the enclosure."

Therefore, if the feeders supplying each of the devices within this special cabinet are extended from one device to the other and if each circuit is then taken separately from directly below each of these devices, special enclosed wiring space would not be required. If, on the other hand, the circuits from each of the devices extend to the ends or to one point or run horizontally for any distance, this wiring space must be provided.—G.R.

Church Wiring

Q. *Must the conductors of a low-voltage remote control lighting system that is installed in a church, having a capacity of more than* 100 *people, be run in a metallic raceway?—F.F.*

A. Article 520 applies specifically as stated in Section 5201, i.e., "the requirements of this Article shall apply to all buildings, or parts of a building, designed, intended or used for . . . public auditoriums . . . and other buildings used for public assembly".

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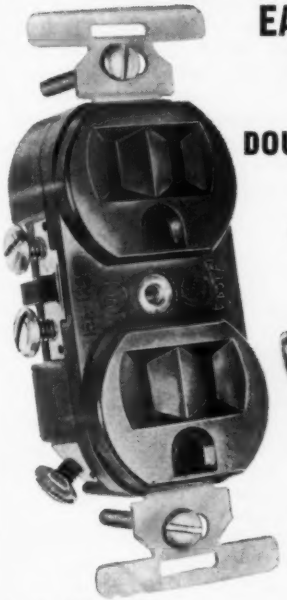

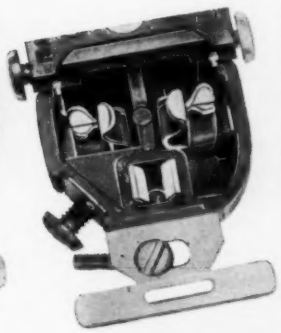

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The wiring methods approved for such installations are covered in Section 5211. Basically, the wiring method must be:

a. Metal raceway, i.e., rigid metal conduit, EMT, flexible metal conduit (greenfield) metallic underfloor raceway, cellular metal floor raceways, surface metal raceways, metal wireways, metal busway and metal auxiliary gutter (See definitions—Raceway), or

b. Type MI Cable.

Two general exceptions are provided for. Exception No. 1 permits other wiring methods as approved in Article 640 for the sound recording, sound reproduction, centralized distribution of sound, public address and speech input systems used in these types of buildings and for electronic organs if they are installed in these buildings.

The second exception permits other wiring methods as listed below if the auditorium involved seats 100 persons or less. In such cases where this relatively small auditorium is involved, the wiring method may be in addition to those outlined above,

a. Armored cable (BX Type), or

b. Where wiring is concealed,

1. concealed knob and tube, or

2. non-metallic sheathed cable (Romex Type).

In the case in hand we are dealing with a church seating over 100 persons. The church is a public auditorium used for public assembly and having a seating capacity of over 100 people so that the second exception does not apply.

Since we are considering the low voltage remote control system for the lighting, we cannot apply the exceptions of No. 1 above. Wiring for such circuits are covered in Article 725 and this Article is not included in those listed in Exception No. 1.

The answer therefore, would be that the low voltage remote control wiring in this church would have to be enclosed in metallic raceways. —B.Z.S.

Wireway in a Paper Mill

Q. I read in a recent issue of your magazine an article concerning the use of wireway in a paper mill and inasmuch as the few paper mills I have been in have been exceedingly wet locations, I have been unable to figure out how such an installation could be made and be in conformance with code

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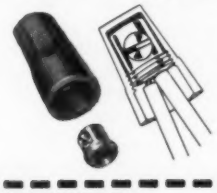

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requirements, as Section 3622 of the code specifically states that wireways may be used only for exposed work in dry locations. Can you explain this apparent discrepancy?—T.E.K.

A. I believe the article you referred to appeared in the August issue and had to do with the use of wiring troughs in such a plant. If that is true, a wiring trough is simply a means of support for conductors suitable for the location in which they are used. Therefore it is assumed that in a paper mill, which is a wet or damp location, only conductors suitable for use in such a damp location would be used in these wiring troughs and inasmuch as such a trough is only a means of support, their use with the proper insulated conductors would not constitute a code violation.—G.R.

Services, Multiple Occupancy

Q. *Referring to sketch below—*

1. Where in the code does it permit you to lower the size wire without fusing, such as in sketch? (Fig. No. 1.)

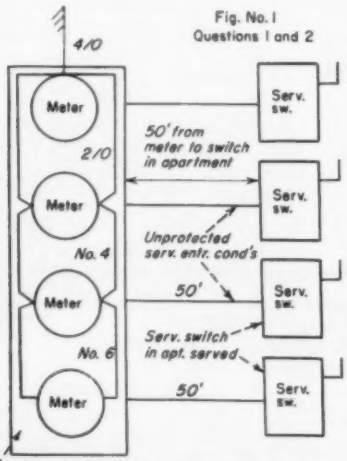
2. Would the 25-ft rule apply, or old 5 ft or new 10 ft rule at panelboards?

3. Is there a master switch recognized in the code, used as in sketch? (Fig. No. 2.)

4. Would master switch satisfy the code as for disconnecting means such as per sketch over six subdivisions?—A.M.S.

A. I assume from your illustration, covered by Fig. No. 1, that you have an outside meter installation serving four apartments, with separate service-entrance conductors running, on the outside wall of the building, to the service equipment located in each apartment. Under such conditions the design shown would be recognized by the code. It is significant to note that all of the conductors running from the meters to the service switches are unprotected and are classified as sub-sets of service-entrance conductors as covered by Section 2301-b. They are smaller than the main service conductors, and since they are service conductors, there is no code provision requiring an overcurrent device where a change is made in size. This also is covered by Section 2301b.

Fig. No. 1
Questions 1 and 2

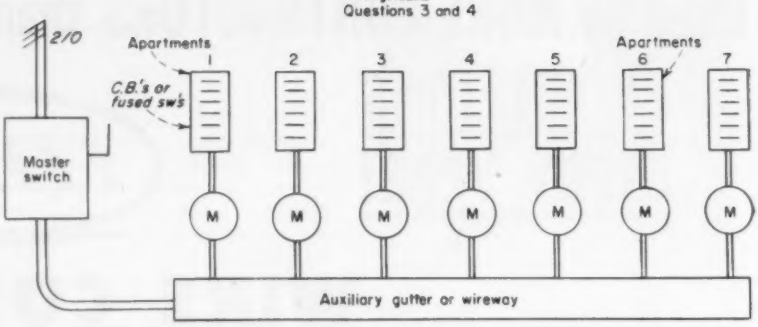


L—Meter trough furnished by local power co. Lugs not large enough for 2–4/0 wires.

The 25-, and 10-ft tap rules, covered by Section 2434c and d of the code do not apply to service-entrance conductors. They only apply to conductors on the load side of the service equipment. While I am not familiar with the terminal design of the meters or the meter trough, it appears to me that the 4/0 conductors should be run in the trough and taps taken from same to each individual meter. This would eliminate any possible question with respect to connecting two wires under one lug.

I assume from the illustration covered by Fig. No. 2 that the master switch contains overcurrent devices and that the meters and the customers' branch circuit panels are located adjacent to one another in a common accessible place. If this is correct, the service terminates at the main switch and fuse, and the conductors running to the auxiliary gutter constitute a feeder. Taps to this feeder to the various occupants' meters may be made as covered by Section 2434c and d of the code. Either a 10- or a 25-ft tap may be made depending upon the nature of the occupants' equipment. If the master switch did not contain fuses it could not be used as the main switch and overcurrent protection required by the code. Section 2351-a limits the service disconnecting means to six switches or six circuit breakers and Section 2371a limits the overcurrent devices to six.

Fig. No. 2
Questions 3 and 4



When one main switch and set of fuses, or a main circuit breaker is installed as shown on Fig. No. 2, the code requirements for services are fully satisfied, regardless of the number of occupants served; and the service rules, Sections 2301b, 2351b and 2371a-4, which concern multiple-occupancy, no longer apply since the service terminates at the main switch and fuse. Under such conditions the branch circuit panelboards serving each occupant could, in my opinion, contain more than six circuit breakers or fuses. The provisions of Section 2440, which concerns the disconnection of fuses before handling, however, applies. To satisfy this rule it would be good practice to use a circuit breaker panel or a dead front switch and fuse panel. Another rule which may be involved is Section 3883, which requires a "lighting and appliance branch circuit panelboard", when supplied by conductors having overcurrent protection greater than 200 amps, to be protected by overcurrent devices rated not greater than the rating of the panelboard. In other words, when the main fuse or circuit breaker had a rating in excess of 200 amps, it would be necessary to install a separate circuit breaker ahead of each panelboard. If fuses were used it would be necessary to have a fused switch in order to satisfy the provisions of Section 2440.—B.A.McD.

Residential Wiring

Q. *It has long been my practice in wiring homes to carry the two circuits for the furnace and deep well pump through thin wall conduit concealed in the cement*

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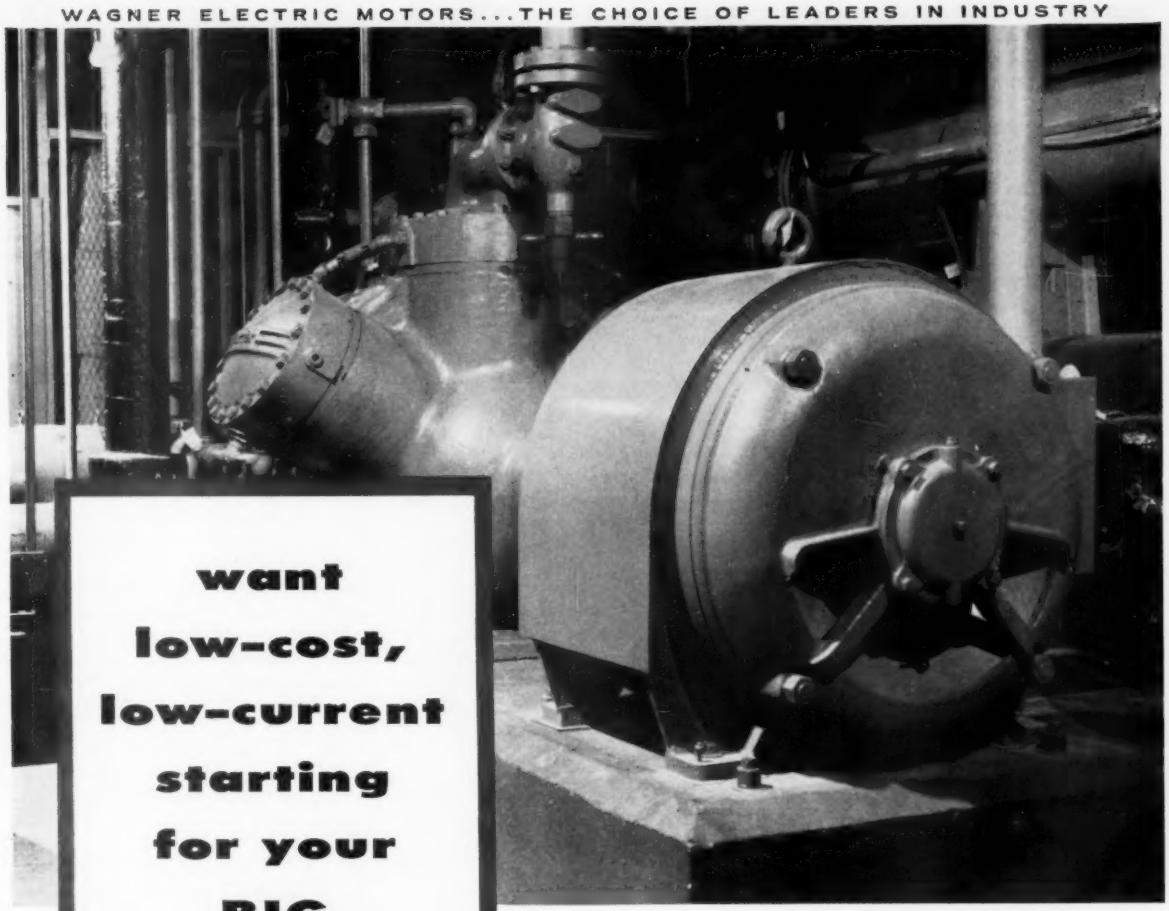

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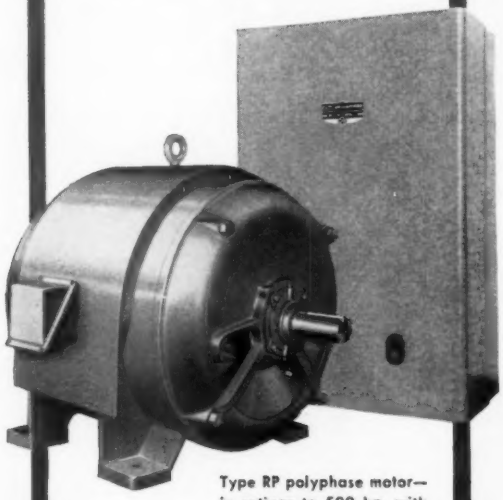

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floor of the basement. Recently I was advised that this was contrary to the code as the basement floor of a dwelling is in direct contact with the earth. Is it true that such an installation would be a code violation?—E.P.W.

A. Section 3482 of the code does state that electrical metallic tubing shall not be used in cinder concrete or fill where subject to permanent moisture unless protected on all sides by a layer of non-cinder concrete at least 2 in. thick or unless the tubing is at least 18 in. under the fill. Therefore the thickness of the floor would determine as to whether or not the use of thin wall conduit in a basement floor was contrary to the National Electrical Code unless the concrete in question used cinder aggregate, in which case, of course, it would be a violation of the code.—G.R.

Receptacles Required—Residential Occupancy

Q. *During a recent trip to the St. Paul-Minneapolis area one of the electrical inspectors I had contact with reported that a lively controversy has developed over National Electrical Code paragraph 2124-f. The change in this paragraph to a maximum of 12 ft between receptacles from the original requirement of 20 ft appears to be the only revision in the first sentence of this paragraph. However, some of the inspectors in that area are, as a result of this change, also revising their interpretation of this section to require that the 12-ft spacing be based on the gross distance around the room which would include doorways, archways and even large openings. The other faction contends the word "gross" in the code does not mean exactly that and they are requiring one outlet for every 12 ft based on the actual footage of wall involved.*

I explained that my interpretation of the word gross indicated that there should be one receptacle every 12 ft and the total measurement around the room must include all openings. In reviewing your recent article in EC&M, your drawing would tend to confirm my interpretation.

As I have promised the electrical inspectors that I would try to obtain more expert counsel on this subject, I would appreciate your advising the correct interpretation of this code rule.—L.H.S.

A. A very definite answer is given to the above question by Official Interpretation No. 358, issued July 7, 1950. It reads as follows:

"Section 2124b, Receptacle Outlets Required in Dwellings.

"Question: May openings, doorways and the like, in room partitions have consideration in determining the application of paragraph b of Section 2124 of the National Electrical Code?

FINDING: No, the word "gross" in the text of this paragraph implies no "discount" for door openings and the like, see computations in Example 1."

Reference to the paragraph on interpretation under the introduction to the code indicates the above interpretation is official and has the status similar to any code rule. Reference to the appendix of the code further emphasizes this contention.

The 1956 revision of the code merely changed the 20-ft provision to 12 ft, which in no way concerns the status of O. I. No. 358. Reference to example No. 1 under Chapter 10 also confirms the above.—B.A.McD.

Hospital Operating Room

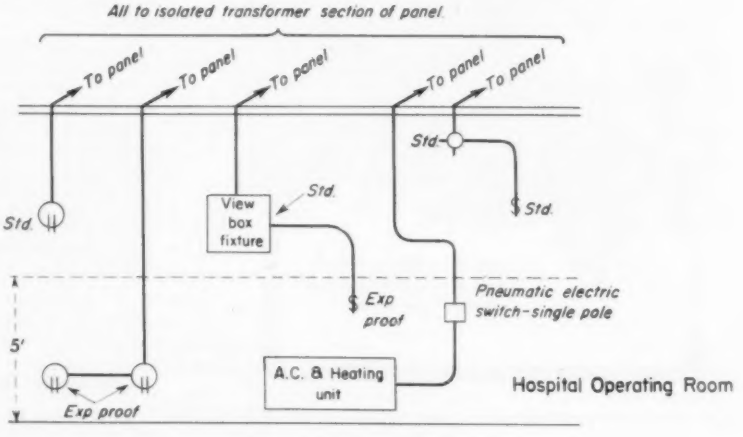
Q. *Please show the seal-off fittings in the following diagram.—C.G.*

A. As defined in Section 5135b2, for the conditions shown, the entire area above the 5-ft level would be considered non-hazardous. So, as far as sealing is concerned only three would be required in the three conduit lines feeding into the area below the 5-ft level, and these should be placed at the 5 ft level or to either side of this level in such a way as to definitely confine the explosive gases to the area below the 5-ft level. Primarily this will require that the conduit be unbroken from where it leaves this Class I, Div. 1 area at the 5-ft level and below, to where it enters the sealing fitting in the non-hazardous area.

Furthermore, particular attention must be paid to the type of sealing fitting. It is possible to use the wrong type and thus defeat the entire purpose of sealing. Thus an EYS or EZS fitting should be installed at the boundary or slightly above it. If it is placed so that the entire fitting is within the 5-ft level, then theoretically at least, it is possible for the explosive vapor to seep through the threads at the top of the sealing plug opening and also at the top of the fitting into the conduit feeding into the top of the fitting and thus transmit this vapor throughout this conduit back to the panel, or to escape through other threaded fittings, etc, into non-hazardous areas and possibly into non-explosive proof devices, etc.

Also in the drawing shown, I would say that a seal-off fitting should be placed next to the switch controlling the view box fixture. However, if the fitting we use to seal off the conduit line is within 18 in. of this switch, then this single seal off should suffice to protect the switch and also the conduit as it leaves the hazardous area.

The pneumatic switch for the heating unit etc., as well as this heating unit, must be approved for Class I, Div. 1 locations. Seals should be placed on either side of this switch and at the heating unit, except that the 18-in. distance rule would be applicable at both locations to eliminate at least one sealing fitting.—B.Z.S.



Maximum Voltage—Lighting Circuits

Q. *Regarding the operation of 400-watt mercury lamps through ballasts having a 440-volt primary you stated several years ago that the operation of 440-volt single phase mercury lamp ballasts on a 440-volt ungrounded delta 3-phase circuit was a definite violation of the code.*

Recently, I have found out that such installations are being installed using ungrounded delta 440-volt circuits with lamps connected across each of the phases. If one phase should accidentally ground out, the other two lines have 440 volts to ground.

My question is, has the code been changed regarding lighting on ungrounded 440-volt circuits or might various groups be interpreting the code some other way than we do.—R.E.R.

A. I am unable to find any change in the 1956 Code which would permit the connection of a 400-watt mercury lamp supplied by a 440-volt ballast, to be connected direct to a 440-volt, 3-phase delta circuit, grounded or ungrounded.

Section 2113 of the code definitely limits the voltage to ground to 300 volts when the circuit supplies ballasts for electric discharge lamps. It also limits the voltage to ground to 300 volts when mogul-base screw-shell lampholders, or other types of lampholders approved for the application are used. I know of no code rule which recognizes the procedure outlined in your inquiry.—B.A.McD.

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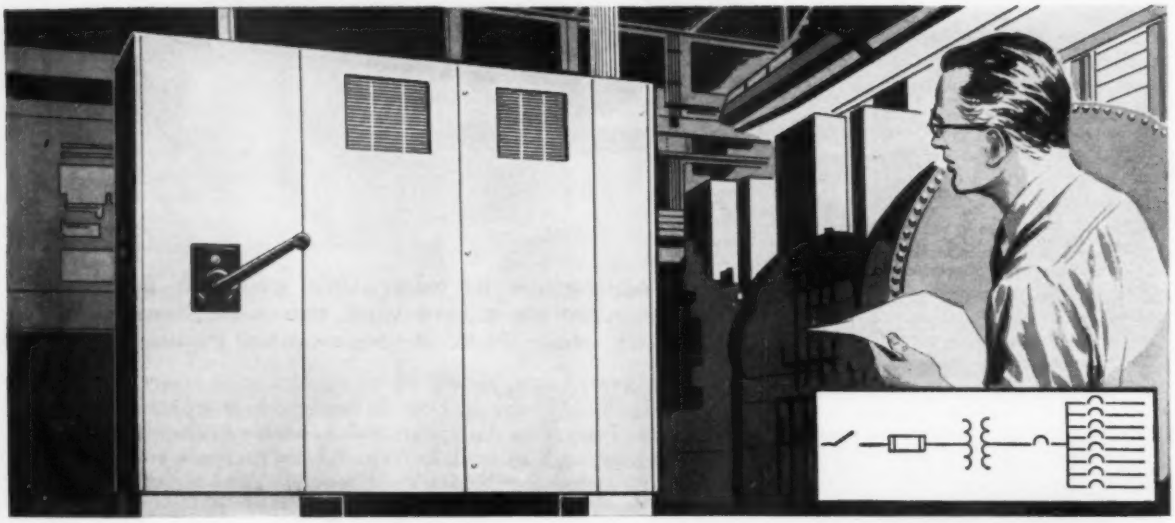

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In the News

Frank Stetka Joins NFPA

Frank Stetka of Washington, D. C., has been appointed Electrical Field Service Engineer of the National Fire Protection Association. He succeeds the late Charles L. Smith. He took over his new position on February 1 and is located in the Chicago headquarters of the International Association of Electrical Inspectors.

Mr. Stetka has been serving as a Supervisory Electrical Engineer in the federal government's General Services Administration since 1956. Before that he was Chief Electrical Inspector and Assistant Chief of the Field Inspection Branch for the District of Columbia. Prior to entering government service in 1930, he had been an electrical contractor.

As NFPA Field Service Engineer, he is Secretary of the Electrical Section, Secretary of the NFPA Electrical Correlating Committee, the National Electrical Code consultant to the IAEI.

Mr. Stetka has been serving as Chairman of the National Electrical Code Panel No. 6 and as a member of Code Panel No. 9. He holds a Master Electrician's license, is a Registered Professional Engineer, a member of the Society of Professional Engineers, and is a past president of the Eastern Section, International Association of Electrical Inspectors.

Richard E. Stevens of Medfield, Mass., has been appointed an Assistant Technical Secretary of the NFPA. He joined the organization in 1950 and has been serving as an engineer of the NFPA staff.

Maintenance and Engineering Show Sets New Records

The Plant Maintenance and Engineering Show in Chicago, January 27-30, attracted nearly 20,000 delegates from 30 countries, while 2500 maintenance and engineering men attended the 25 sessions of the concurrently-held Conference.

With more than 425 manufacturers exhibiting almost 10,000 different products having a gross valuation of over $7½-million, and occupying nearly 120,000 sq ft of exhibit space, the Show was 20% larger than the previous record, set last year at Cleveland. And, with 66 speakers drawn from companies located in 22 different states, plus Canada and the District of Columbia, the Conference program for this 9th annual meeting represented the broadest cross-section of engineering opinion ever assembled to discuss this vital subject.

At the first session, W. E. Chandler, manager of maintenance services, organic chemical division, Monsanto Chemical Co., St. Louis, Mo., stated that the objective of maintenance management is to protect capital investment in machinery and equipment, insure continuity of operation of productive equipment, conserve utilities as influenced by equipment maintenance, promote plant appearance and safety, and control repair costs. Total maintenance costs, he said, fall into three classes: those which control the amount of maintenance work which is performed; those which control the efficiency of work execution; and other elements such as wage rates and costs related to overhead, materials and contracts.

He then cited numerous interesting facts based upon a 6-year maintenance study in his own plant, including the statements that (1) repair costs can be reduced by eliminating sources of high costs, as revealed by equipment case histories and standards; (2) production losses can be reduced by recording, studying and minimizing the causes; (3) repair costs and production losses and their causes must be known before a sound preventive program can be established; (4) formal, comprehensive programs have reduced maintenance costs through improved work execution; (5) screening, preplanning and scheduling of the majority of the work is a definite requisite for a successful program; (6) repetitive jobs can be isolated and improved by establishing standard job methods based on work-simplification studies; and (7) formal training of mechanics and foremen is a sound investment in efficiency.

Basic Fundamentals

To establish a broad base for more detailed analysis in other sessions, the Fundamentals of Preventive Maintenance were presented by a 3-man panel consisting of John Van Coevering, supervisor of facilities engineering, magnetic materials section of General Electric in Edmore, Mich.; Forrest Fischer, general maintenance foreman for the Moloney Electric Co., St. Louis, Mo.; and Bernard Robichaud, maintenance engineer of the Toni division of Gillette Company in St. Paul, Minn.

After offering a variety of definitions for the general subject, the panel collectively described and defended such important factors as records, inspection schedules, planned overhaul, spare parts inventories, training, machine histories, coded cards and check lists, the latter being based upon (1) analysis and evaluation of existing instructions and practices, (2) manufacturers' manuals, (3) stockroom spare parts usage records, (4) machine histories, (5) talks with manufacturers' servicemen when they visit the plant, (6) production supervisors' comments, and (7) comments from maintenance men doing the jobs. It was pointed out that these check-lists are kept up to date by periodically reviewing their effectiveness and constantly changing them when errors, deviations or revisions are necessary. Master check-lists are kept in a loose-leaf binder, and all changes are made on these copies. Then, at frequent intervals, these master copies are duplicated for daily reference on the job.

In developing this subject, the speakers gave numerous examples of applied preventive maintenance for such electrical items as cranes, high current rectifiers, electric fur-

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nance contactors, fork-lift trucks, power distribution panels, and circuit breakers. It was also mentioned that even when "formal" training is not adopted, it is still necessary to train maintenance men to think preventatively, since a small repair neglected today could be a major overhaul job tomorrow, and that taking time to locate the cause of trouble can go a long way toward eliminating the recurrence of that symptom.

Rotating Equipment

In a talk having direct interest for electrical men attending the conference, M. J. Wohlgemuth, assistant to the manager of the service department, apparatus division, Westinghouse Electric Co., East Pittsburgh, Pa., gave numerous timely tips concerning the Upkeep of Electric Motors. In this discussion he covered misapplication and overloading of motors, improper selection of units for tasks at hand, the importance of visual inspections and insulation tests, the formation of sludge on windings due to accumulations of oil, dust, carbon and metallic particles.

He also included several unusually complete check-lists related to visual inspection of both ac and dc motors, segregating the suggestions as to stator and rotor windings, armatures, brushes and general. These categories were further detailed so that, for example, ac motor stator windings were discussed in terms of general appearance, coil finish, cleanliness, coil condition in slots, condition of wedges, checks for wedge movement, evidence of coil looseness, coil condition in end windings, tightness of blocks and spacers, tightness of cord lashings, coil surfaces, compound migration, insulation swelling, evidence of corona or slot discharge distress, condition of the core, tightness of laminations, ventilation ducts and heating of finger plates. Bearings and lubrication likewise received his minute inspection and analysis, so that his talk was of definite value to those delegates who were responsible for any type of rotating electrical equipment.

Welding Techniques

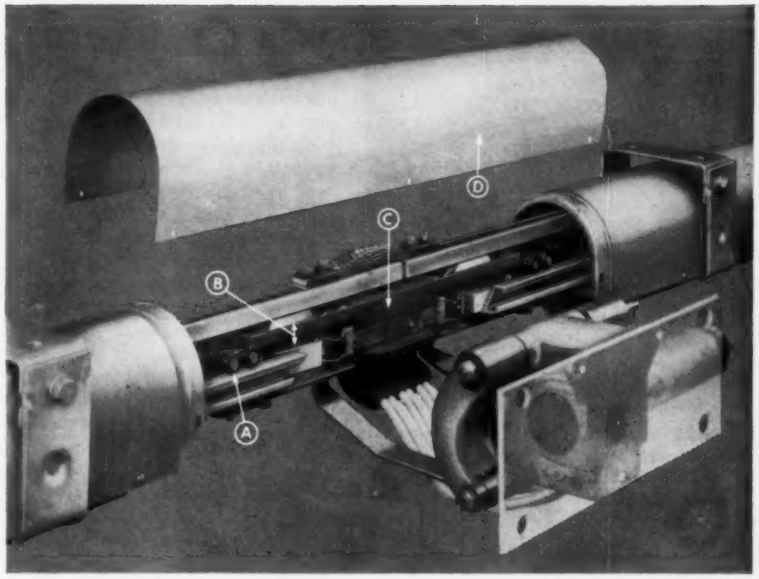
Discussing Welding in Maintenance, Ray Kolb, head foreman, welding shop, Whiting Refinery, Standard Oil Co. of Indiana, stated that maintenance encounters many

JIM SEAL, electrical project superintendent for Fischbach and Moore during installation of power, lighting, audio and video wiring at NBC's color TV center in Burbank, Calif., discusses characteristics of distribution system with Wilber Roser, senior engineer for NBC, during one of his still-frequent visits to this pace-setting concentration of production studios, technical facilities, research laboratories and executive offices on the west coast.

diversified welding problems related to metals wear, corrosion and erosion, breaks and other causes. When such jobs arise, he said, some fundamental questions that arise are: What is the base metal? Does the thickness or pattern of the metal present any special problems? What welding process should be used? What size and type of electrode or filler metal should be selected? and, Who is going to do the job?

Answering these questions in detail, Kolb then suggested many practical solutions based on his wide experience, such as how to determine the composition of metal by its shape, weight, color, scale or rust. By shape, he continued, one can differentiate between castings, forgings, extrusions, pipes and plates. Weight permits us to differentiate between aluminum, magnesium, iron and steels. Color characterizes most copper base alloys. Scale and rust can frequently segregate plain carbon or low alloy steels from stainless types or high nickel copper alloys. Spark tests and nitric acid spots also may provide useful information of a materials-analytical nature.

After discussing problems related to depositing heavy welds, welding light gauge steel, accessibility of the area to be welded, rigidity and expansion forces, he then described various techniques recommended for various types of work, such as tungsten or metal in-



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DELTA-STAR ELECTRIC DIVISION

FORT WORTH, TEXAS boasts two stalwart sons in G. E. "Cliff" White (left), Empire Electric Company and vice president of NECA district 5, and C. E. "Bud" Wann, NECA Chapter manager in Ft. Worth, shown here at the 1957 NECA convention in Cincinnati.

ert gas welding, submerged arc welding, metallizing and an analysis of electrodes intended for mild, low alloy and stainless steels, hard and corrosion-resistant surfacing, cast iron and aluminum.

Number of questions from those in attendance attested to the interest of Mr. Kolb's discussion.

Planning Emphasized

The importance of Planning and Scheduling was advocated by Stuart Snyder, head of maintenance control in the public works department of the U. S. Naval Gun Factory in Washington, D. C., and by John Mansheim, maintenance engineer, W. A. Sheaffer Pen Co., Fort Madison, Iowa.

Defining their terms, it was noted that "planning" means the deciding of methods, programs and procedures of action to maintain plant facilities in acceptable conditions of utility; and that "scheduling" is the means of committing shop personnel to specific work sufficiently in advance to assure the coordination of the men, materials and equipment necessary to achieve maximum efficiency of job performance.

Benefits related to proper planning were enumerated as including the (1) provision of specific information to prepare and justify budget requests, (2) estimating of work loads for the future to permit selection and training of maintenance men without haste, and (3) permission of effective scheduling so that work can be completed when most convenient. It was also mentioned that, for efficient scheduling, it is necessary to have (1) an acceptance of schedules by plant management, (2) an adequate work backlog for all crafts, (3) scheduling and planning by those responsible for approvals, (4) a system for determining availability of materials and manpower, (5) a method for handling emergency work without disrupting scheduled jobs, and (6) a means for coordinating work requiring several crafts.

The effectiveness of proper planning and scheduling was emphasized by Mr. Mansheim who stated that Sheaffer Pen, back in 1951, had a "maintenance" department of 64 employees working nine hours a day six days a week. Many of these employees were in the handi-man class who should have been transferred to other assignments. As a result of having some mis-fits, the morale of the good men was decreasing and the efficiency of the department was mediocre. At that time the men were classified by craft groups; undesirable or incompetent men were either transferred or laid off; training classes were set up; wages were raised materially; and approximately $50,000 was invested in new equipment and general modernization of the maintenance department. So great was the improvement in overall efficiency that the maintenance department, although now consisting of only 25 men, at present has to work only 8 hours a day 5 days a week to keep on top of their assignments. And, in savings in labor alone, the new system is saving over $166,000 a year.

Costs Analyzed

Cost Control was yet another subject attracting considerable delegate attention, and this component of maintenance was discussed by S. J. Beaton, supervisor, maintenance control, industrial products department, Canadian General Electric Co., Ltd., Toronto, Ont., and by John Green, plant facilities engineer, Leeds & Northrup Co., North Wales, Pa. As an illustration of how one control system could function, a 4-part work order was presented, the four parts going respectively to the maintenance department for record purposes, to the accounting department for billing purposes, to the maintenance man as a job instruction memo, and to the head of the division or area of the plant in which the work is being performed. In this illustration, each work order was coded, showing whether it was related to (1) equipment breakdown, (2) preventive maintenance, (3) fabrication or installation, (4) building repairs, (5) building construction, or (6) work performed outside the plant. Each manufacturing division in the plant is advised each month what their costs related to these six types of maintenance endeavor are, so that management has a direct measure of overall maintenance, non-repetitive work orders and general operating costs.

It was also mentioned that the maintenance department benefits directly from this system, since the reports point out where repeated electrical failures could be eliminated by replacement with different or better parts or units, or where excessive maintenance costs might be lessened by replacement with more adequate or economical equipment.

In summary, it was concluded that a cost system such as this would (1) acquaint management with all cost components of operation so that general economies could be sought for and achieved, (2) provide maintenance records which would reduce ultimate costs by suggesting improved methods, redesigned equipment or modified operation, and (3) reduce maintenance costs still further by suggesting proper planning and scheduling. Since cost control depends to a great extent upon budgets which are merely educated estimates of future costs, it was further emphasized that the estimator should not be rushed or put on the spot so that he has to hurriedly guess at costs before considering and evaluating all possible costs to be encountered.

Perhaps the national scope of maintenance was emphasized most effectively in two panel discussions

HOME TOWN electrical contractor at the 1957 NECA convention in Cincinnati was E. B. Conradi of Barkley Electric Co., Inc.

INTERESTED MEMBERS attending the business sessions at the 1957 NECA convention in Cincinnati included: Hugh M. Childress (left), Transformer Inspection Co., Royal Oak, Mich. and David Jacobs, David Jacobs, Inc., Hunter, N. Y.

titled Maintenance in *Small* Plants (having up to 50 maintenance employees) and Maintenance in *Little* Plants (with 10 maintenance men, or less), for the speakers for these two sessions came from such diverse cities as Portland, Ore.; Newark, N. J.; Los Angeles, Cal.; Norristown and Philadelphia, Pa.; Westfield and Skaneateles, N. Y.; Grand Rapids and Kalamazoo, Mich. These cities, in order, were represented by Svante Eikrem, plant engineer, Hyster Co.; Homer A. Smith, plant engineer, Diamond Alkali Co.; James M. Weeks, plant engineer, Proto Tool Div., Pendleton Tool Industries, Inc.; C. H. Pedersen, project engineer, Superior Tube Co.; Howard Leadbeater, plant engineer, American Pulley Co.; A. J. Monta, chief engineer, Welch Grape Juice Co.; W. C. Bradley, plant engineer, Cowles Chemical Co.; Morton M. Charnley, Jr., plant engineer, Rapids-Standard Co., and J. M. Abernathy, plant engineer, American Cyanimid Co.

Working in differing industries and under widely-varying conditions as they do, these men collectively offered a wealth of wide-latitude, useful information on such subjects as generation vs purchase of utilization-level power, maintenance of motors and lighting installations, transformers and m-g sets, identification of equipment, historical record cards, use of outside contractors, work-order systems, work measurement, the trend to automation, use of modern tools and equipment, union relations, requisitions and stockroom methods, maintenance organization set-ups, scheduling and planning work, estimating and budgeting, daily and

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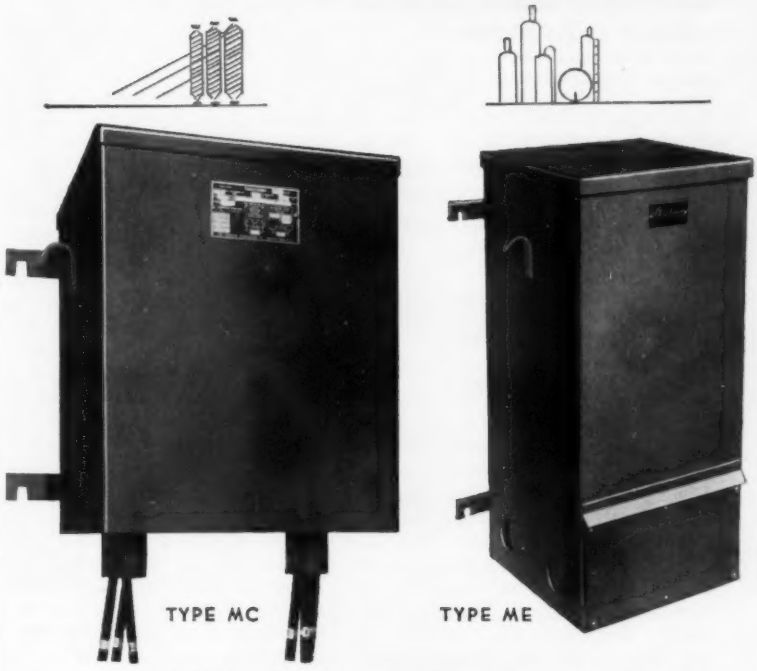

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FRIENDLY CONVERSATION, always the order of the day during recesses in the technical sessions at the 1957 NECA convention, is here enjoyed by G. C. White (left), Empire Electric Co., Ft. Worth, Texas, and John W. Jenner, John W. Jenner Inc., Wichita, Kansas.

weekly work schedules, safety and fire protection, repair vs emergency work, cost control, zone vs central crews and stockrooms, allocation of responsibilities, and adjustment of personalities.

Labor Problems

Labor Relations in both union and non-union shops were analyzed by two plant engineers: Frank Bradley, Forstmann Woolen Co., Passaic, N. J., and George Wallace, Gillette Safety Razor Div. in Boston, Mass. Both agreed that the human element doesn't lend itself to rigid application of formulas, and, when terminologies, definitions, working conditions and personalities vary, considerable variation in practices can result. However, since management is responsible for the development of people as well as the direction of things, supervisors and foremen have the constant job of educating (union stewards as well as rank-and-file employees), arbitrating grievances, maintaining discipline without belligerence, and being fair, consistent and honest in all contacts with all employees.

It was pointed out that the union steward enjoys top seniority under most contracts; he is an employee in the shop with regular job assignments to perform, and, in addition, he is the appointed representative of labor in all dealings with management. Therefore the steward has prestige and rights as well as obligations, and he therefore must be treated with respect and consideration as well as firmness. Since union demands are usually set sufficiently high to permit compromise, the steward should be tactfully notified that bluffing will not be taken lightly, yet, since he also has a trying situation to face, it is poor policy to "try to make a monkey out of him". Treating antagonism with antagonism can only result in poor labor relations.

In developing this discussion, both speakers presented useful tips on the training of supervisors, maintaining discipline, handling grievances, job evaluation, incentive plans, training workers, creating constructive job attitudes, upgrading the men and regular performance reviews.

Economical Factors

On a subject closely allied with maintenance, L. G. Gannon, manager of power service, Commonwealth Edison Co., Chicago, Ill., told delegates How to Save on Electric Power Bills, citing many useful facts related to demand and energy charges, power and load factors, staggering operations and altering methods of control, using capacitors or synchronous motors. He also mentioned that doing a job electrically may not always result in reducing the power bill, but it generally contributes to a plant's overall economy. To prove this point, Gannon stated that, in 1939, the cost of electric power represented an average of only 1.41% of the value of the plant product in all industries, but that, in 1953, although the total *consumption* of electricity had *tripled,* the proportionate cost of electric power had dropped to less than ½ of 1% (.47); a decrease of 66%. Ten years ago, he concluded, each industrial worker used approximately 11,000 kwh annually, whereas today the average is 20,000 kwh.

Engineering Responsibility

Another panel discussion of equal interest to delegates concerned the Broad Responsibilities of Plant Engineering for, again, interestingly contrasting viewpoints were presented by P. P. Weidinger, manager, plant engineering and tool design, Bailey Meter Co., Cleveland, Ohio; William C. Wallin, chief, plant engineering department, Western Electric Co., Winston-Salem, N. C.; and O. B. Patton, plant engineer, Towmotor Co., Cleveland, Ohio.

In this panel discussion it was brought out that the average plant engineer of today has a Bachelor's or Master's degree; he has a working knowledge of construction methods, equipment installation, light and power supply, welding, production and process methods, metallurgy and heat treating, cost accounting and management organization, safety and insurance codes, public and labor relations. From a personal viewpoint he should also have mechanical aptitude and ingenuity, versatility and adaptability, ability to cooperate with others under pressure and irregular hours, and physical stamina as well. This engineer is responsible for all physical aspects of over-all plant facilities and supporting services for production. He designs and constructs, or contracts for and supervises. He helps train maintenance personnel, provides written operating instructions, and furnishes engineering know-how on all repair and maintenance activities. Therefore we can conclude that the functions of the plant engineer are to investigate, design, construct, operate, maintain, repair and replace.

Benefits Defined

In summarizing the objectives of the Conference, general chairman L. C. Morrow, consulting editor of *Factory Management and Maintenance,* voiced the truism that although it is hard to predict how much value each delegate might receive from attending these meetings, it is a fact that ideas and information cannot be acquired without exposure to thoughts of others, and that often a single idea gained at a conference can more than justify the time and money involved in attending. He also pointed out that many of the facts presented by various speakers conceivably had been initially assembled by them for their own interests, yet these men were willing to share their findings and experiences because they believed that individual units of industry could advance only in proportion to progress in the industry as a whole. Stressing the importance of the maintenance man, Morrow then cited Census and Commerce statistics to prove that the per-worker investment in American plants and equipment is now approximately $6,250; that the per-worker total capital plant investment (including inventories and working capital as well) amounts to $11,480, and that each full-time *maintenance* worker (employed by plants taking part in this-year's Conference program) is responsible for $63,662 worth of plant equipment.

John Doris Elected President N.Y. Contractors

At the annual meeting of the New York Electrical Contractors Association, Inc. held last month, John Doris was elected president. Other officers elected were John W. Frommer vice president; Jacques Mann treasurer; and John J. Morrissey secretary.

The Executive Committee consists of John Doris, chairman, A. Lincoln Bush, H. F. Fischbach, J. W. Frommer, S. W. Hurowitz, E. A. Kahn, Frederick Latzer, William Liebfried, Sidney Lipkins, L. C. MacNutt, Jacques Mann, J. J. Morrissey, H. C. Parke, J. M. Watters, Jr., and H. A. Webster.

M. S. Blumberg was named chairman of the Membership Committee; J. W. Werther chairman of Legislative Committee; J. P. Morrissey chairman of Constitution and By-Laws Committee; J. W. Frommer chairman of Trade Jurisdictional Committee; and E. A. Kahn representative on Board of Governors, NECA.

PAUL M. HENKELS of the electrical contracting firm of Henkels and McCoy, Philadelphia, Pa., attended the meeting of the Board of Governors at the 1957 NECA convention in Cincinnati.

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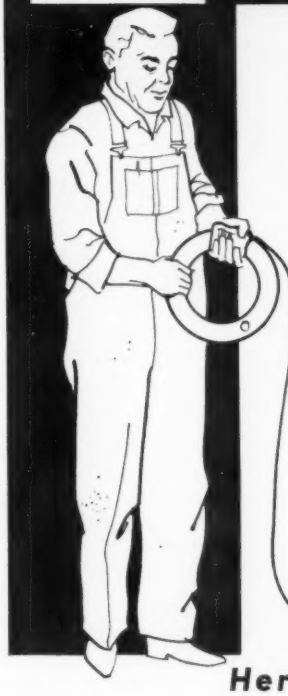

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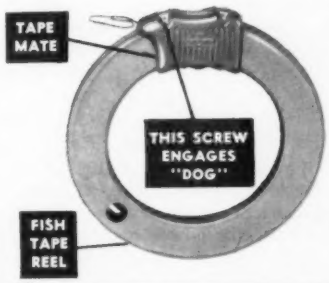

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"Medallion" Home Introduced to Builders

At the 14th annual National Association of Home Builders Show held in Chicago during the past month the Medallion Home was introduced publicly for the first time. At a meeting devoted to the use of electrical facilities, R. E. Boian, Manager, Live Better Electrically Program, stated "the purpose of the Medallion Home program is: to establish national recognized standards of Electrical Living, *to meet all the electrical requirements of Modern Living*, including *installation of Basic Major Appliances, Light for Living, Full Housepower*, and *co-ordination with Local Wiring Programs*." The advantages of the program that were discussed during the session are: increased prestige for builders, faster sales—greater profits, satisfying consumer demand for more and better electrical living, and generating greater confidence of the prospective home buyer.

The remainder of the session was a discussion of the many new electrical developments of a technical, business and promotional nature, that will help builders get more value out of their dollar investment in electrical goods and services.

The program also included a discussion on Light For Living; given by T. Cox, Director, American Home Lighting Institute; J. H. Jensen, Supervisor, Home Lighting, General Electric, Nela Park; and R. E. Schmidt, Supervisor, General Electric, Nela Park. They, by means of slides and a panel-type discussion, made it known that Light For Living probably cost much less than most builders realize. Here are the factors that every builder should take into consideration: good lighting averages less cost than most of the other added features being used to attract customers and close deals, and good lighting is a definite merchandisable feature that is being increasingly demanded by buyers.

L. E. Barrett, Chairman, Executive Committee National Wiring Bureau, stated in his address "the use of electrical power in the home is increasing at an astounding pace. In two decades, average annual household electrical use has soared from 805 kilowatt-hours in 1937 to 3,164 in 1957—a boost of 394%. Industry authorities predict an average annual use of 6,000 kilowatt-hours by 1967, a target regarded as too conservative in some quarters.

Other speakers were William McGrath, Chairman, Heat Pump Committee, ARI; C. F. Kreiser, Chairman, Electric Heating Committee, NEMA; John Worthman, Ft. Wayne, Indiana, Builder; and S. B. Aronson, Sales Manager, Berko Electric Manufacturing Corporation, NEMA. Their presentations made mention of the following facts. C. F. Kreiser: "The Gold Medallion Home Program which is part of the overall Live Better Electrically campaign should result in the construction of 20,000 electrically heated homes during 1958." S. B. Aronson: "Electrical Heating offers the builder an excellent opportunity to really merchandise his homes with dynamic sales features. He (the builder) is in a position to interest discriminating home buyers with individual thermostats in every room. Electric heat offers space saving; space need not be allocated for a furnace or boiler, or for storage tanks or area for a combustible fuel." William McGrath: "With proper controls, a plant installed to cool a house can also be used to heat it. Estimating that more than 25,000 installations are in service today, heat pump equipment has already become a practical and desirable method of providing all-year air conditioning in many parts of the country. Since climate conditions and fuel cost comparisons can determine where heat pumps are best suited, builders are urged to investigate possibilities in their own communities."

T. O. McQuiston, Chairman, Commercial Division, EEI, brought the session to a close with these reminders to the builders. "Your electrical industry allies sincerely

J. M. DOSTER, Doster and Egan, electrical contractors, Syracuse, N. Y., an active member of NECA in his chapter, took a deep interest in the business sessions at the 1957 NECA convention in Cincinnati.

NEW JERSEY delegation at the 1957 NECA convention in Cincinnati included: (L-R) Augustus Hasbrouck, Hasbrouck Electric Co., Inc., Hackensack, N. J.; James McKinnes, Watson-Flagg Engineering Co., Paterson, N. J.; and William Nordling, Nordling Dean and Company, Inc.

KANSAS CITY, MO. is business hometown to George Trinastich (left) of Squire Electric Co. and Clyde Tareton of Plaza Electric Co.

ELECTRICAL CONTRACTORS came from all over the country to attend the 1957 NECA convention in Cincinnati and discuss their common problems—as demonstrated by Leonard Hall (left) Garfield Electric Co., Rifle, Colorado and Herbert Clifford, electrical contractor from Lynn, Mass., who paused in their conversation for this photo.

wish to do everything within their power to help you sell homes, since the growth of our respective industries must go hand in hand. We are certainly seeing a tremendous upsurge of interest all across the electrical industry in the new home market. Many factors are responsible for this upsurge: (1) the tremendous population growth; (2) the flight to the suburbs; (3) the revolution in America's concept of living, changing us from a nation of renters to a nation of home owners; (4) the many advances in residential construction, with its trend toward packaged livability in the new home, instead of pure shelter; (5) the forward-looking FHA philosophy, which removed many of the financing road blocks to technical developments and advancements. The electrical industry — manufacturers, distributors, contractors, electrical utilities and leagues, adequate wiring bureaus and all other groups—is vitally interested in helping you sell homes."

W. W. HANKS of the Southern Electric Service Co., Charlotte, N. C., was one of the many NECA members who sat in on the meeting of the Board of Governors at the 1957 NECA convention in Cincinnati.

GEORGE F. BRITT, McClure Electric Company, Dallas, Texas, was part of the large representation from the Lone Star state at the 1957 NECA convention in Cincinnati.

New

MEGGER® LOW RESISTANCE OHMMETER

- **Completely Self-Contained**
- **Convenient, One-Man Operation**
- **Battery or Rectifier-Operated Models**

RANGES
0 to 1,000 microhms
0 to 10,000 microhms
0 to 100,000 microhms
0 to 1 ohm

The new Megger Low Resistance Ohmmeter is a direct-reading instrument of sturdy, compact design. Has wide application in electrical maintenance for resistance measurements of electrical conductors, joints, contacts and windings of the low resistance type in oil circuit breaker assemblies, rotating electrical equipment, transformer and coils. This instrument is also most useful for controlling manufacturing and assembly processes which include identification and classification, in terms of resistance, of metal and metal alloy components.

IDEAL FOR FIELD OR BENCH USE

Two models of the Megger Low Resistance Ohmmeter are available. One has a battery power supply for field use. The other has a rectifier which can be plugged into any ordinary lighting circuit outlet for bench use. Each is equipped with automatic quick-acting circuit-breaker.

FEATURES

1. Measures accurately to 10 microhms
2. Open, easy-to-read, 3¼" scale
3. 4 ranges: In addition to the x1 position on the selector switch it multiplies scale x10, x100 and x1000
4. Small size—13" x 6" x 7"
5. Light weight—only 10 pounds
6. Sturdy carrying case keeps instrument, leads and prods in one place, ready for use.

NEW CLAMP DESIGN ON TEST LEADS

Special clamp type test leads 18 feet long are available on special order. The extra length facilitates tests in elevated or remote locations without moving the instrument close by. Especially important in testing large circuit breakers. Clamps are of duplex type, each makes current and potential connection when applied. This permits one man to make tests.

B 802

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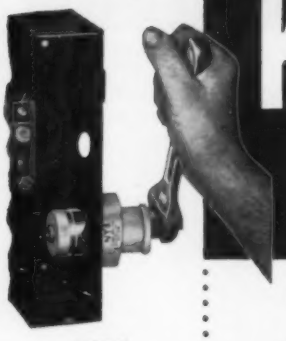
Original NYE 4 POINT KNOCKOUT PUNCH



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Each Punch ½" to 4" has the ORIGINAL 4-POINT cutting feature which takes the toil out of the job. Cuts clean, quick knockouts speedily, smoothly and burrless. Ball bearing chuck prevents friction. Hand or hydraulic. Try a NYE and know the best. Order today from your local supply house.

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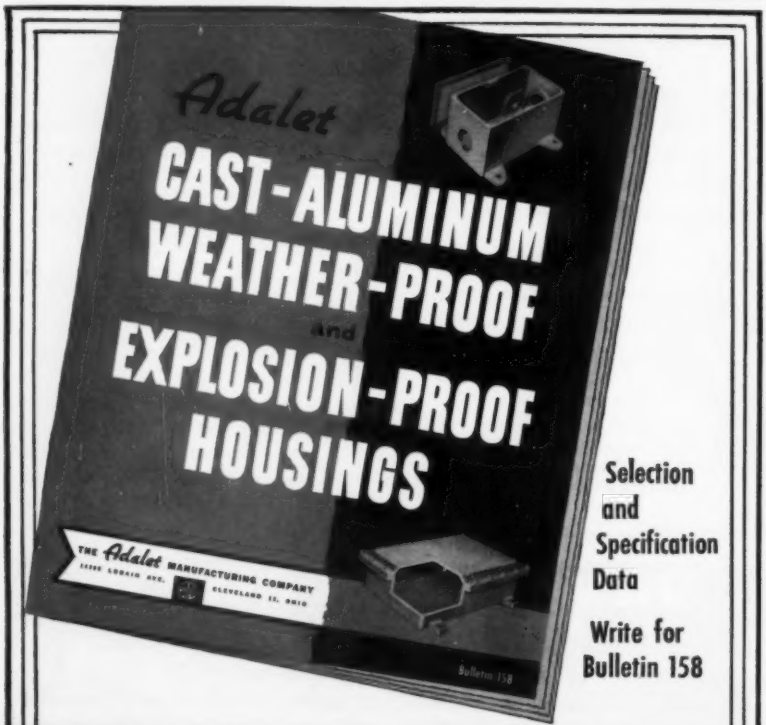


Selection and Specification Data

Write for Bulletin 158

THE Adalet MANUFACTURING COMPANY
14300 LORAIN AVENUE • CLEVELAND 11, OHIO

Independents Describe Objectives

A new interstate electrical contractor's organization, the "Associated Independent Electrical Contractors of America" (Electrical Construction & Maintenance, November, page 266), has announced its organizational makeup and objectives as follows:

"Executive Structure: President, Vice President, Secretary-Treasurer and one Director from each member association, one Director from each future qualifying Association membership.

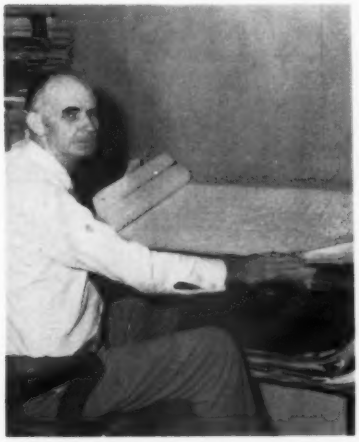
"Operation: Representation from each local Association membership by the Director or his official representative.

"Voting Membership: Five or more electrical contractors under one organizational name of their choosing; closed shop, open shop, or combination of both not affiliated with a similar regional association.

"Purpose: To render service to the electrical contractor, to acquire and disseminate business information to its members and the electrical trade. To strive to elevate the standards of the electrical industry and to promote the general welfare of the electrical industry and those dependent upon the electrical industry. To observe pending legislation at the local, state, and national level, endeavor to ascertain its values and intentions and pass on to the mem-

ROBERT W. MEANS, supervisor of the central facilities building at the new Dresser Center, Houston, Texas, is constantly on the job supervising construction of the building, shown behind him, in which H. P. Foley Electric Co. is installing the electrical equipment.

ELECTRICAL CONTRACTOR Morley T. Pike (right) presents Certified Lighting certificate to Rt. Rev. E. A. Moran, pastor of The Most Precious Blood Church in Hyde Park, Mass., upon completion of extensive relighting and electrical modernization program in that edifice. Looking on is Boston Edison Co. lighting engineer Ted Williams, who worked closely with Pike Electrical personnel in developing the details of this quality-quantity certified lighting job.



J. H. BLASDELL, electrical engineer for Fisk Electric Company, Houston, Texas, is shown here going over some of the plans on the Federal Reserve Bank job which he is handling and which boasts an 840-cycle, 600-volt distribution system for lighting throughout the windowless building.

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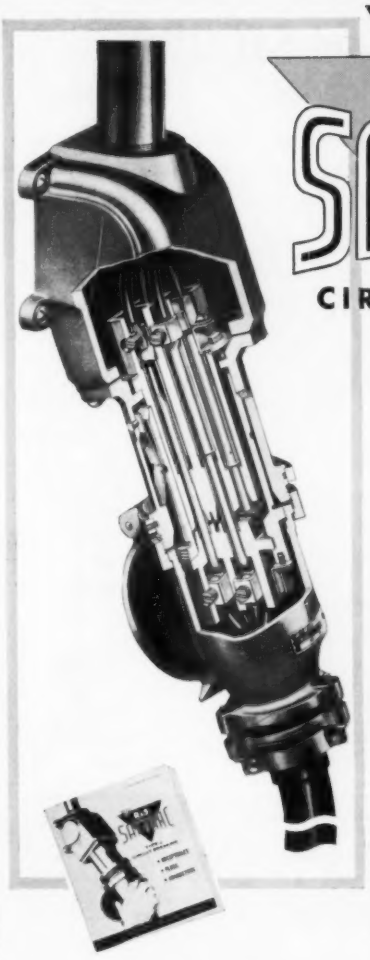
bership an unbiased opinion. To assist all local member associations to perform their duties when so requested. To oppose vigorously all unfair trade practices or any acts or implications that tend to discriminate against any electrical contractor, regardless of affiliation, by any person, group of persons, including legislative bodies at any level. To oppose, and expose if necessary any person or persons who are found after due consideration responsible for causing loss of confidence in the electrical industry."

Associations participating in the



R&S SAF-T-ARC®
CIRCUIT BREAKING

RECEPTACLES
PLUGS
CONNECTORS

. . . Assure Complete Safety
EVEN UNDER OVERLOAD!

Russell & Stoll has integrated many important design features into Saf-T-Arc to keep pace with the advancing electrical needs of modern industry.

It will pay you to specify Saf-T-Arc . . . for safety's sake! These Type J devices not only assure complete circuit breaking safety under full rated loads — they're safe even when subjected to 50% greater than rated loads. Deep insulating chambers confine and snuff out harmful arcing and flashover by de-ionization and lack of oxygen—eliminating possible injury to personnel or plant equipment.

Units Are Individualized

Plugs fit *only* into receptacles or connectors having the same electrical characteristics. Two grounding arrangements are offered — one style provides grounding through a separate pole and receptacle and plug housing—while the other style provides grounding through the plug and receptacle housing only.

Quick and Easy Conversions

Conversions may be made in the field between the Weathertight Flap Cover and Waterproof Screw Cap assemblies — an exclusive R & S feature. Housings and component parts assemble readily. Regular service interior assemblies interchange quickly to create reverse service devices.

Saf-T-Arc supplements—but does not replace—the standard R & S Angle Type Lines widely used for many years.

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Not Minutes Not Hours

The Penndrill Model "E" is a complete drilling unit, easily operated by one man and drills holes from 1 to 14 inches in diameter up to 19 inches deep.

Requires no set up time and presents no problems for drilling holes close to walls or in corners—one man can carry it up stairs.

Using diamond bits, it drills neat, clean holes vertically, horizontally or at any angle in concrete, asphalt, marble, granite, including any pipe, conduit, steel, etc. that might be encountered in the drilling.

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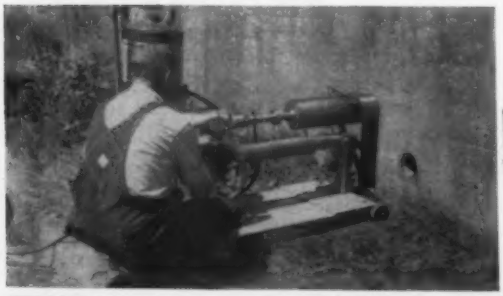

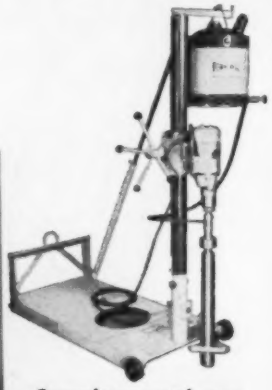

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The Only One Shot Bender That Bends Without Changing Frames

- **Pipe and Rigid Conduit**
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- **Radiant Heat Coils**
- **Bus-Bar—Flat and Round Bar Stock**

The Only Bender
Available With or Without Remote Control and or Motor Pump

- **Actual Savings 75%** and more in direct costs of cutting, threading or welding, assembling, fitting and elbows.
- **This MULTI-PURPOSE BENDER Will Handle *All* your requirements. Makes any bend or offset up to 180° *In Only One Setting.* Cold — Without Filling. Any size up to 8".**
- **WITHOUT Experience anyone can make perfect, identical bends . . . without guessing. Bend indicator and Bending Chart (Copyright 1956) furnished with each bender.**

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WELDON W. HENDERSON of Bernard Johnson and Associates, Houston, Texas, is a top-notch electrical engineer who brings skill and imagination to his electrical design work, as represented in the Medical Towers building and the underground high-voltage system for Dresser Center, just to mention two of his many large-scale projects.

initial organizational conference included: Independent Electrical Contractors Association, Oklahoma City, Okla.; Master Electricians Association of Texas, Houston, Texas; Independent Electrical Contractors Association, Tulsa, Okla.; Alamo City Electrical Contractors Association, San Antonio, Texas; Independent Electrical Contractors Association, Ft. Worth, Texas; United Electrical Contractors Association, Dallas, Texas; and Association of Independent Electrical Contractors, New Orleans, La.

NISA News

Materials, methods and management will be the subjects covered at the three morning sessions of the NISA 25th Jubilee Celebration in New Orleans May 11-14. NISA executive vice-president Joseph M. Harrington announced that the program is nearly complete and will be announced shortly.

Other highlights of the convention will include:

— A chapter officer's breakfast.
— Mardi Gras Ball.
— Walking tours of the French Quarter for women guests.
— Post-convention tours.

Mr. Harrington has urged NISA members and others interested in attending the silver anniversary event to make their hotel reservations early to assure themselves of accommodations in the headquarters hotel, the Roosevelt. "Late registrants may be assigned rooms at other downtown hotels," he said.

Registration should be made in advance, accompanied by check for $22.

• • • •

NISA exhibits in Chicago at the Plant Maintenance Show, January 27-31 and in Seattle at the Electrical Industry Show, February 9-12, attracted large audiences. The Chicago show was sponsored by that city's chapter; in Seattle the Puget Sound Chapter was in charge of arrangements.

• • • •

One of the largest crowds to attend a chapter gathering assembled on December 10 for the Great Lakes Chapter Christmas party, held at Botsford Inn, Farmington, Mich.

• • • •

A Christmas party for members and their wives was held by the Los Angeles Chapter on December 10 at Michael's Restaurant.

• • • •

NISA's new Miami Valley Chapter met on December 16 at Suttmiller's Restaurant in Dayton, Ohio, to hear Richard Wareham, president of Special Electric Co., Milwaukee.

• • • •

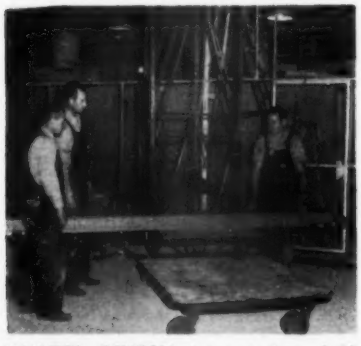
Waverly Inn on Route 10, Cheshire, Conn. was the scene of the January 7 meeting of NISA's Connecticut Chapter.

• • • •

Southwestern Chapter's spring meeting will be held outside that chapter's official territory—in New Orleans. Reason: a good one—NISA's 25th Jubilee Celebration is scheduled to be held in the Crescent City May 11-14!

• • • •

Quaker City Chapter met on January 8 at Beck's. The chief speaker



WALTER BENSON (second from left), job foreman for California Electric Company, supervises raising of low-reactance busduct sections into position by means of platform hoisting rig which was used to facilitate installation of electrical system in new Marchant Calculator building in Oakland, Calif. Seen here assisting him are electricians Forest Chandler and Lee Stuart.

One dependable quality

Monarch

renewable fuses

FASTER UNIFORM SHORT CIRCUIT PROTECTION

Cost no more — save you more

Sold thru distributors everywhere

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Monarch ELECTRIC CORPORATION Jamestown, New York

Better installations in less time

Simple, quick to install

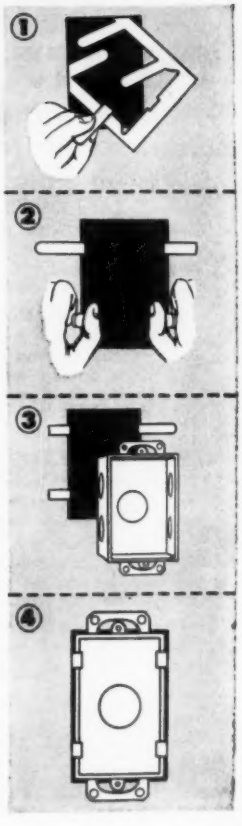
BLACKHAWK 540 BOX SUPPORT

stays rigidly in place

The Blackhawk No. 540 one piece box support slips into the wall opening and tabs are bent back to hold it in place. After the switch box is installed, the tabs are bent to the inside of the box squeezing it firmly in place. It's that simple and quick.

It makes a permanent installation because the Blackhawk 540 box support is a large single piece . . . providing rigid, unified support. It does not wiggle or saw because it is parallel to the wall.

For simple, quick, permanent switch box installation, specify Blackhawk No. 540 box support. Ask your electrical distributor for Blackhawk.



Blackhawk Industries

BLACKHAWK INDUSTRIES

DUBUQUE, IOWA

No Guesswork Seating Cable!

SHERMAN

TERMINAL LUGS

Uni-Crimp with PICTURE WINDOW Design

Sight Hole lets you see when cable is seated and ready for crimping. The Uni-Crimp AN Solderless Type lug is designed in one piece and made from electrolytic copper for maximum conductivity. Beveled mouth for ease of cable entry. Crimping Tool locator spot on barrel. Conforms with Military Specifications (AN659) for aircraft installation. Angle, Two Hole, or Center Former types as needed.

SHERMAN CRIMPING TOOLS

Sherman tools designed for use with Uni-Crimp give up to six tons of indenting pressure for 100% air free connections. **Rotate the dial to cable size plainly marked on dial.** Tool applies proper amount of pressure. One Indentor and one Nest accommodate all cable sizes. Hand and pneumatic bench tools available.

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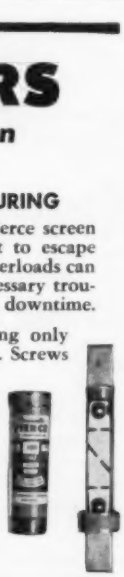
SERVICE CONTRACTORS

Here's the fuse that can make your job easier

- **NO UNNECESSARY BLOWS DURING SAFE OVERLOADS**—exclusive Pierce screen vent design permits gases and heat to escape freely. Only shorts and dangerous overloads can cause a blow. This saves you unnecessary troubles, and cuts down on costly plant downtime.
- **EASY LINK REPLACEMENT,** requiring only a screwdriver and a few seconds' work. Screws holding link have nuts locked in position. Sturdy tubular bridge assures perfect link contact and knife alignment. You don't need a lot of parts—just the replacement link.
- **LOWER FUSE COSTS.** Because your fuse body doesn't become charred by frequent blows, excessive heat and afterblows, Pierce Fuses last 6 to 8 times longer. It's worth investigating!



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PIERCE RENEWABLE FUSES, INC., Leicester, N. Y.

I would like to see and compare one of your Balanced Lag Pierce Fuses:

( ) Knife Blade Type ( ) Ferrule Type

Name.....

Company.....

Address.....

City.....State.....

CHICAGO, ILLINOIS, was well represented at the 1957 NECA convention in Cincinnati, by a large group of electrical contractors, including the distinguished gentlemen shown here: (L-R) Wm. Weisenborn, Local Electric Company; C. Gall, Henry Newgard Company; L. W. Johnson, Johnson Electric Company.

was Richard Wareham of Special Electric Co.

• • • •

Labor costs, including "non-productive" office help was discussed by Paul Keating at the January 9 meeting of New England Chapter. Other speakers were Paul Leicht who discussed material costs; Brent Smith, who spoke on overhead costs; and Alfred Elson Jr., the NISA national president, who talked on the growing importance of profits.

• • • •

Robert J. Thomson, former manager of service and distribution sales for Delco Products, joined Metlock Electric Co., Cincinnati, as general sales manager.

• • • •

NISA's Trade Relations Committee met in St. Louis on December 18. Members included William J. Wheeler, Robert Ward Sr., H. Ed. Grant, G. E. Jones, Alfred Elson Jr., David Sandman, and Paul Sievert.

New Cost Manual

Electrical Construction Cost Manual by Ralph Edgar Johnson, President, Sturgeon Electric Company, Denver, Colorado; 448 pages; McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y.; $10.00.

This newly-published manual presents a practical method for making accurate cost estimates of electrical construction work—and for bringing all the vital cost factors of a job together in an integrated cost system.

In clear, logical steps, it (1) es-

tablishes fundamental methods for installing electrical work in various types of construction; (2) develops standard assemblies, such as housings, terminals, and panelboards, for these various conditions; (3) sets up unit costs covering the material and labor for each assembly; and (4) gives a detailed estimating procedure for applying the unit costs.

This helpful guide also gives methods for take-off, pricing, and summarizing the estimate. Included is a practical plan for applying overhead, and charts for applying profit. Various job factors, and their effects on cost estimating, are fully explained. Recent advances in electrical construction, such as low voltage switching and various types of wiring, are covered in this cost manual.

The book treats material identification in a helpful manner, including classification, numbering, abbreviations, and material release procedure.

Many clear drawings illustrate fundamentals of installing electrical work, and show the assemblies which form the nucleus for unit costing. All methods and procedures are demonstrated by means of practical, realistic examples.

In addition, the book contains useful graphs which supply source data for labor costs, and tables to interpret these graphs into usable information for estimating. Numerous charts also show source data for basic labor units which back up the unit costs for standard assemblies.

BOB SCHWARTZ, half of the contracting team of Schwartz & Lindheim of Oakland, Calif., checks details related to large-area luminous-ceiling installation in San Francisco with his job foreman Andrew Kumas.

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UNIVERSAL ELECTRIC POWER AND LIGHT PLANTS

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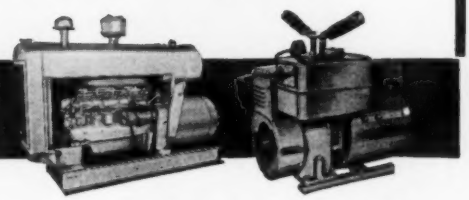

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MARINE ENGINES

match power factor correction to the motor

with UNIPAK CAPACITORS*

It's easy with Sprague's *complete selection* of designs in sizes from ½ to 15 KVAR. Each is completely self-contained . . . needs no additional switches or fuses. Unique Sprague unit cell construction gives you maximum reliability, long term trouble-free service.

Write for complete information in Bulletin PF-1150 available free on request to Industrial Capacitor Division, Sprague Electric Co., **333** Marshall St., North Adams, Massachusetts.

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need no batteries

Never fail in any emergency because they operate without current of any kind over a distance of many miles. Can be moved with the job as construction progresses or serve permanently where power failures may occur. In outdoor and indoor models.

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Next time when your problem is costly "down time" . . . depend on HELWIG for immediate Red Carpet Service . . . Yours at no extra cost.

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MILWAUKEE 10, WIS.

THE PACIFIC NORTHWEST Electrical Industry Exposition, to be held in Seattle's Civic Auditorium February 14-16, is expected to set records both in the number of products displayed and in the attendance of electrical contractors, engineers and engineering students, electricians and inspectors, maintenance men and consultants, utility personnel and architects. Sponsored by the 239-member Puget Sound Electrical League, the exposition already has signed up 200 exhibits of manufacturers and service firms. Pictured above is the League's executive committee responsible for exposition arrangements. From the left, these men are Bob Thompson, Organization Service Bureau, exposition manager; Jim Hartwig, North Coast Electric Co., exhibit chairman; Dave Edwards, Seattle Light Co., secretary; Bob Lemmon, Line Material Co., Div. of McGraw-Edison, general chairman; Howard Bayley, Industrial Electric Co., finance; A. J. Flechsig, Westinghouse Electric Supply Co., records; Al O'Brien, Phelps Corp., industrial relations; Ralph Neilson, attendance; W. C. Schafer, Crouse-Hinds Co., publicity, and John Daniel, Square D. Co., manager's aide.

DATES AHEAD

National Electrical Week—An all-industry event, February 9-15.

National Adequate Wiring Conference—Hotel Statler, Detroit, Mich., February 20-21.

First National Lighting Exposition—Coliseum, New York City, March 9-12.

Electrical Contractors Assn. of Ontario—London Hotel, London, Ontario, Canada, March 20-22.

Electrical Industry Show and Electrical Maintenance Conference—Shrine Exposition Hall, Los Angeles, Calif., March 27-29.

Illuminating Engineering Society — **Northeastern** Conference, Statler Hotel, Hartford, Conn., April 10-11; **East Central** Conference, John Marshall Hotel, Richmond, Va., April 14-15; **South Central-Southeastern** Conference, Lafayette Hotel, Little Rock, Ark., April 24-25; **Southwestern** Conference, Washington Youree Hotel, Shreveport, La., April 28-29; **Midwestern** Conference, Hotel President, Kansas City, Mo., May 1-2; **Inter-Mountain** Conference, Whitman Hotel, Pueblo, Colo., May 8-9; **South Pacific** Conference, El Cortez Hotel, San Diego, Calif., May 12-13; **Pacific Northwest** Conference, Multnomah Hotel, Portland, Ore., May 22-24; and **Great Lakes** Conference, Sheraton Hotel, Rochester, N. Y., June 23-24.

Rocky Mountain Electrical League—Annual convention, Shirley Savoy Hotel, Denver, Colo., April 13-20.

National Industrial Assn. — 25th "Jubilee Celebration," Hotel Roosevelt, New Orleans, La., May 11-14.

National Fire Protection Assn.—Annual meeting, Palmer House, Chicago, Ill., May 19-23.

National Association of Electrical Distributors—50th annual convention, Civic Auditorium, San Francisco, Calif., June 9-13.

Edison Electric Institute — Annual convention, Convention Hall, Boston, Mass., June 9-12.

New York State Assn. of Electrical Contractors & Dealers, Inc.—Annual convention, Whiteface Inn, Lake Placid, N. Y., June 29-July 4.

Illuminating Engineering Society — National Technical Conference, Toronto, Canada, August 17-22.

International Association of Electrical Inspectors—Western Section, Sheraton-Cadillac Hotel, Detroit, Mich., September 7-10; **Northwestern Section,** Billings, Mont., Sept. 15-17; **Southwestern Section,** Southern California, September 22-24; **Canadian Section,** Montreal, Quebec, Canada October 10-11; **Eastern Section,** October 13-15; **Southern Section,** Miami, Fla., October 20-22.

International Association of Electrical Leagues—Annual Conference, Washington, D. C., October 1-3.

National Electrical Manufacturers Assn. — Annual conference, Hotel Traymore, Atlantic City, N. J., November 10-14.

National Electronics Conference, Inc.—Hotel Sherman, Chicago, Ill., October 13-15.

National Electrical Contractors Assn.—Annual convention and National Electrical Exposition, Adolphus Hotel, Dallas, Texas, November 16-21.

LIVE BETTER ELECTRICALLY

Among the Manufacturers

Headquarters Announcements

Circle F Mfg. Co., Trenton, N. J., has purchased the Waterbury Mfg. Div. from the Chase Brass & Copper Div. of Kennecott Copper Corp.

Hill Transformer Co., San Carlos, Calif., has established a new Industrial Products Division for producing special-duty transformers.

Porcelain Products, Inc., has moved its Low Voltage Division offices from Findlay, Ohio, to Carey, Ohio.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—C. B. Smith, director of service, Industries Group; J. V. McGuire, assistant general manager, Pittsburgh Works; D. W. Webb, manager of switchgear department; H. P. Pinkham, assistant general manager, Boston Works.

Russell & Stoll Co., New York—Albert F. Stoll, chairman of the board; Frank L. Novak, vice chairman of the board; Alexander Hammond, president; C. J. Merz, treasurer-assistant secretary; J. A. Heinzelman, secretary; Thomas H. Hannon, Jr., vice president in charge of sales; Edward M. Rothen, vice president in charge of engineering; Norman Tanner, vice president in charge of manufacturing.

Phelps Dodge Copper Products Corp., New York—Edgar P. Dunlaevy, executive vice president; S. Allen Jacobs, president, Inca Mfg. Div., Fort Wayne, Ind.; John J. Conlon, William K. Dunbar, Jr., and Earle A. Mitchell, vice presidents; Charles F. Moody, works manager, Habirshaw Cable and Wire Div., Yonkers, N. Y.; Lewis F. Buckman, works manager, Bayway Div., Elizabeth, N. J.

International Resistance Co., Philadelphia, Pa.—Terry A. Halpern, sales manager, Asheville, N. C., plant.

Hardwick Hindle, Inc., Newark, N. J.—Thomas B. Ure, vice president in charge of sales.

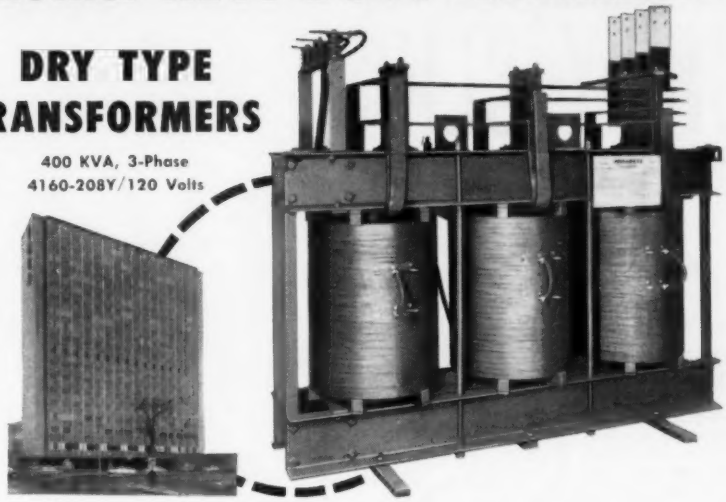
Robertshaw-Fulton Controls Co., New York—Boothe Ingram, manager of distributor sales, Acro Division.

Feedrail Corp., New York—Albert F. Stoll, chairman of the board; Frank L. Novak, president; Alexander Hammond, executive vice president; Charles J. Merz,

another HEVI-DUTY installation

DRY TYPE TRANSFORMERS

400 KVA, 3-Phase
4160-208Y/120 Volts



PLACE: New Central YMCA, Milwaukee
ARCHITECTS: Grassold-Johnson & Associates
GENERAL CONTRACTOR: Gebhard-Berghammer Inc.
ELECTRICAL CONTRACTOR: Staff Electric Co.
ELECTRICAL CONSULTING ENGINEER: Wanty & Associates

HEVI-DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

Write for Bulletins 100 and 200 today!

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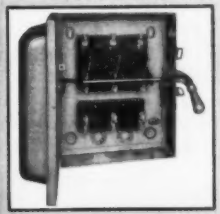
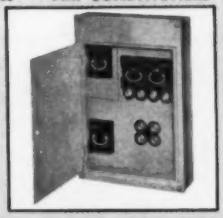
That Meet the New NEMA Standards
KNIFE BLADE INDUSTRIAL
FUSIBLE AND NOT FUSIBLE



30 TO 1200 AMPERES

SERVICE EQUIPMENT
A Fusible Device for Every Need
DRYER — RANGE — WATER HEATER
HEATING PANELS — AIR CONDITIONERS

30 TO 200 AMPERES



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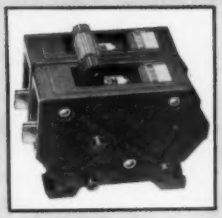
4" x 4" AND 6" x 6" FULL INSIDE DIMENSIONS 1 TO 5 FOOT LENGTHS

WIRING TROUGHS
With Knockouts and Without
A COMPLETE LINE OF FITTINGS

SINGLE — DOUBLE POLE AND SWITCHING NEUTRAL
15 to 50 Amps.
THERMAL MAGNETIC QUICK MAKE & BREAK



"E-Z-RED"
CIRCUIT BREAKERS
40 to 210 Amp. Enclosures
INDOOR & OUTDOOR

WRITE FOR FREE NEW CATALOG

The WADSWORTH Electric MFG. CO., INC.
COVINGTON, KENTUCKY.

Millions of Steel
JIFFY CLIPS
Serving the Electrical Industry

Specify
MINERALLAC
HANGERS, CLIPS, STRAPS, BUSHINGS

Expert design, choice materials and controlled manufacture have built "top-service and longest life" into Minerallac Electrical Specialties. That's why the electrical industry "prefers Minerallac"... In steel and Everdur for hanging pipe, conduit, BX cable, etc.

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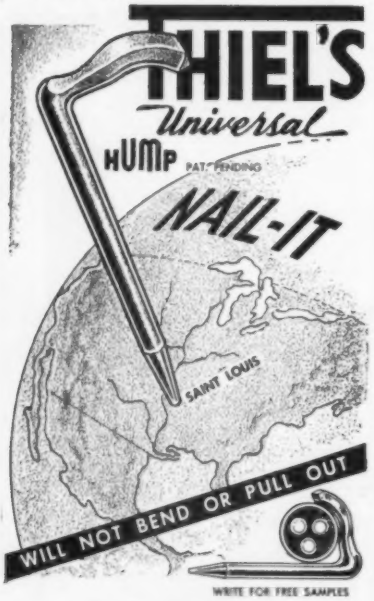

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• Essential for Electrical Men

Another FIRST FOR THIEL IN THE NEW HUMP DRIVE NAIL-IT STRAP. THE HUMP HAS A STURDY HEAD TO INSURE EASY-DRIVE WITHOUT BENDING OR PULLING OUT. MADE OF #8 HEAVY WIRE. ZINC PLATING PREVENTS RUST.

COPPER PLATED FOR PLUMBER'S USE — AVAILABLE

SOLD ONLY THRU LEADING ELECTRICAL WHOLESALERS

THIEL TOOL & ENGINEERING CO., INC.
1417 N. MARKET ST. LOUIS 6, MO.

treasurer and assistant secretary; J. A. Heinzelman, secretary; Russell R. Stout, vice president in charge of sales.

Essex Wire Corp., Fort Wayne, Ind.—George C. Martin, director of Technical Service Dept., Magnet Wire Division.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.—Walter W. Finke, vice president, in addition to present duties as president of the Datamatic Division.

John A. Roebling's Sons Corp., Trenton, N. J.—E. George Hartmann, vice president—sales; W. C. Palmer, general product manager; F. T. Updike, sales manager.

General Electric Co., Cleveland, Ohio—George E. Matilo, specialist for retail lamp sales, Large Lamp Dept.

Westinghouse Electric Corp., Pittsburgh, Pa.—Gwilym A. Price, chairman of the board; Mark W. Cresap, Jr., president; E. V. Huggins, chairman of the executive committee of the board of directors and vice president; John K. Hodnette, executive vice president; George G. Main, vice president—finance, and treasurer; Francis E. Dalton, controller; Carlisle P. Myers, corporate secretary and general counsel; Russell B. Read, assistant treasurer and planning director.

Cutler-Hammer, Inc., Milwaukee, Wis.—Thomas J. Manning, manager of new plant in Lincoln, Ill.

Clark Controller Co., Cleveland, Ohio—R. L. Puette and B. H. Carlisle, general divisional managers.

Union Metal Mfg. Co., Canton, Ohio—C. A. Streb, chairman of the board; V. J. Lajeunesse, president.

TWO TEXANS who are busily engaged in the broad field of electrical construction in the Houston area are: Haig Nias (left), superintendent for Fisk Electric Company on the Meyerland Shopping Center job and John Ownby, electrical engineer supervising the project for Fisk Electric Company.

Pyle-National Co., Chicago, Ill.—H. R. Weibel, manager of field sales.

I-T-E Circuit Breaker Co., Greensburg, Pa.—Arthur W. Maas, manager of Industrial Product Sales, and Howard Graybill, manager of Utility Sales, R&IE Equipment Division.

Regional Appointments

NEW ENGLAND

Sunbeam Lighting Co.: Fred J. Vorlander, Boston, representative in Maine, New Hampshire, Vermont and Massachusetts.

Ramset Fastening System: S. F. Nicholas, Jr., representative in New York, Connecticut and Rhode Island.

Federal Pacific Electric Co.: John W. Muse, district sales manager of New England sales organization, headquarters in Boston, Massachusetts.

Standard Transformer Co.: John F. Kerrigan, Hamden, Conn., sales representative in Connecticut.

MIDDLE ATLANTIC

Carrier Corp.: Roy H. Smiles, Philadelphia, eastern regional manager for Unitary Equipment Div.

Ramset Fastening System: D. W. Champlin, district sales manager for New Castle County, Del., lower New Jersey and eastern Pennsylvania.

National Supply Co.: W. A. Leiser and Co., Philadelphia, sales agent in eastern Pennsylvania, southern New Jersey and Delaware for Spang-Howarduct underfloor duct.

Minneapolis-Honeywell Regulator Co.: Louis Belford, eastern sales manager, Commercial Div., headquarters in New York.

SOUTH ATLANTIC

Ramset Fastening System: A. G. Moore, district manager in Virginia, Maryland, Delaware and Washington, D. C.; R. E. Mullis, sales manager in eastern Tennessee, North and South Carolina, and Georgia.

Sunbeam Lighting Co.: Louis J. Coleman, representaive in North and South Carolina, office in Charlotte, N. C.

Allis-Chalmers Mfg. Co.: W. P. Bell, sales manager for Industries Group in Washington, D. C. office in Washington.

C & D Batteries, Inc.: William G. Baynard, sales representative in Charlotte, N. C. area.

Berko Electric Mfg. Corp.: H. M. Summerell, sales representative in Virginia.

MODERNIZE

YOUR STOCK ROOM LIGHTING

MULTI "ILE LITES"

Will give uniform illumination where you need it from the top to the bottom shelf with no lamp glare when you look down the aisle.

Reflector is porcelain enameled — the best for lifetime cleaning.

Mounting flexibility thru pendent — box cover — angle or feed thru sockets. Pull chain sockets also available for all types.

MULTI ELECTRIC MFG. Inc.
SEND FOR CATALOG
4237 W. LAKE ST.
CHICAGO 24, ILL.

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Equipment, Materials, Supplies and Services for Electrical Construction—Maintenance—Repairs

Rotometers - Plan Measures
• Tally Counters • Voltmeters • Megohmeters

R. A. KOENEMAN COMPANY

1400 Delmar Blvd. St. Louis, Mo.
International Trade Mart New Orleans, La.

MAIL ORDERS PROMPTLY FILLED

TO manufacturers of equipment and those offering special services, this section offers an inexpensive means of keeping products or services regularly before your potential customers—the readers of ELECTRICAL CONSTRUCTION & MAINTENANCE. The small spaces available here provide opportunity for you to be represented in every issue at low cost. Can we serve you?

ELECTRICAL CONSTRUCTION & MAINTENANCE

TWO MIDWESTERNERS attending the business sessions of the 1957 NECA convention in Cincinnati are Al Kahn, Monroe Electric Co., Chicago, Ill. and Wm. T. Lemberg, Lemberg Electric Co., Inc., Milwaukee, Wisc.

EAST CENTRAL

General Electric Co.: Gordon E. Brown, manager of South Central sales district, office in Memphis, Tenn.

C & D Batteries, Inc.: George A. Delbos, in charge of Packaged Electric Power Co., Detroit representatives covering Michigan territory.

Sunbeam Lighting Co.: J. P. Tendick, sales representative for Wisconsin and upper peninsula of Michigan, office in Brookfield, Wis.

Gould-National Batteries, Inc.: F. B. Steele, district manager in Chicago for Industrial Division.

Ward Leonard Electric Co.: Martin-Rettger, Inc., Cleveland Heights, Ohio, sales representative for northern Ohio.

WEST CENTRAL

Sunbeam Lighting Co.: Chassaing Brothers-Lighting, Clayton, Mo., sales representative for St. Louis sector, Missouri, Kansas, Colorado and Southern Illinois.

Ramset Fastening System: E. P. Gavin, district manager for Alabama, Arkansas, Louisiana and western Tennessee; K. E. Van Scoy, sales manager for Iowa, Kansas, Missouri, Nebraska and Oklahoma.

General Electric Co.: Harry W. Bourgeois, district manager, Delta Large Lamp sales district, office in New Orleans, La.

Allis-Chalmers Mfg. Co.: R. E. Morris, manager of St. Louis district, Industries Group.

WEST

Ramset Fastening System: R. H. Ernst, district manager for southern California; F. A. Mullen, sales manager for northern California.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT • BUSINESS
EQUIPMENT — USED OR RESALE
OPPORTUNITIES

UNDISPLAYED RATE

(Not available for equipment advertising)

$1.80 a line, minimum 3 lines.

POSITIONS WANTED undisplayed rate is one-half of above rate, payable in advance.

Box Numbers—Count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

EQUIPMENT & BUSINESS OPPORTUNITY advertising $17.50 per inch.

EMPLOYMENT OPPORTUNITIES—$24.00 per inch, subject to Agency Commission.

An Advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches to a page

Send new ads to Classified Advertising Div., Electrical Construction & Maintenance, P.O. Box 12, New York 36, N. Y.

GENERATORS FOR SALE

3—with water wheels, 600/3/60
1—Westinghouse, 183 KVA
1—Westinghouse, 340 KVA
1—G. E. 180 KVA

2—Crocker Wheeler Generators 750 KVA, 250 Volts DC with steam turbines.

ALL GENERATORS IN OPERATING LOCATION

COMER MACHINERY CO.
Charlotte, N. C. Atlanta, Ga.

WANTED DYNAMOMETER

100 HP Motoring, 200 HP absorption complete with Motor Generator, Controls, Scales, Panels, Etc. Advise make, price, condition and age.

DENISON RESEARCH FOUNDATION POWELL, OHIO

SALESMEN—SIDELINE

To call on dealers. Sell special wires, special extension cords, heating elements, parts for small appliances and lamps, etc. No inventory, liberal commission. Sell anywhere in U. S. Handle with your other lines. Write:

JANDORF ELECTRIC MFG. CO.
3600 Woodland Ave., Baltimore 15, Md.

New "SEARCHLIGHT" Advertisements received by February 19th will appear in the March issue subject to space limitations.

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P. O. Box 12 New York 36, N. Y.

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CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

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WANTED
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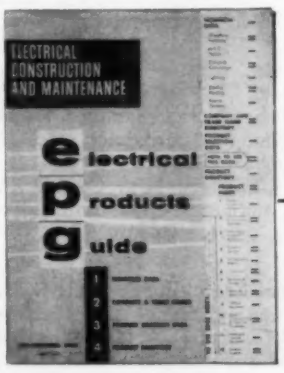
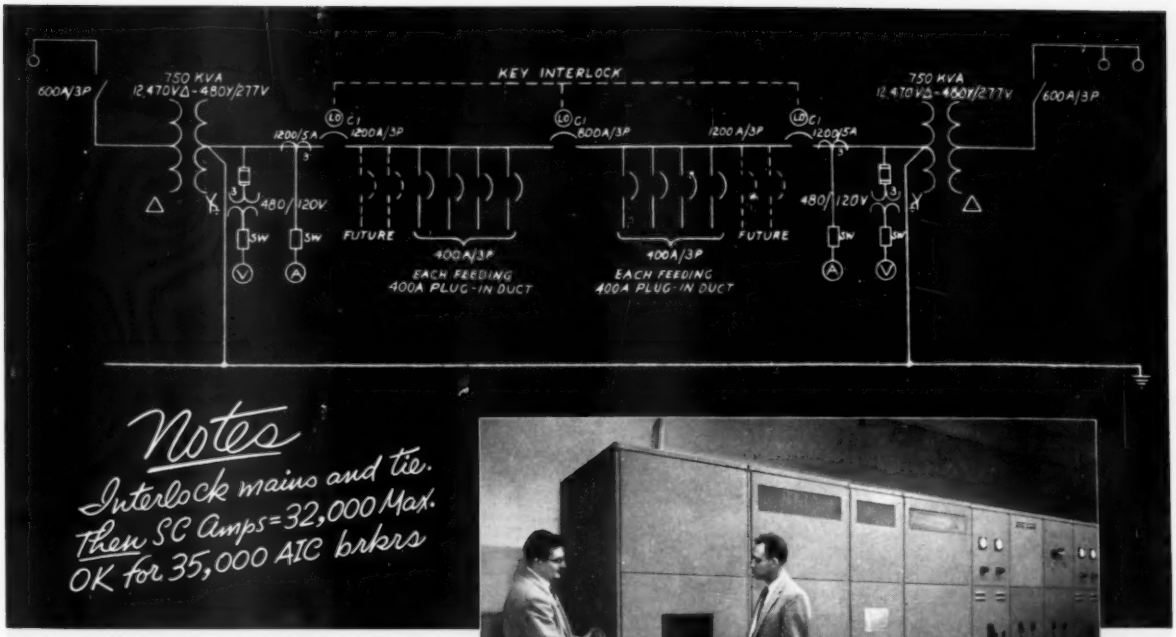


• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.



Notes
Interlock mains and tie.
Then SC Amps = 32,000 Max.
OK for 35,000 AIC brkrs

In Unit Substations COORDINATED DESIGN

Cuts Costs and Saves Space!

Square D designs and builds a complete line of substations for any application, indoor or outdoor—with dry or liquid-filled transformers—with large air breakers or molded case breakers—with motor control units.

A typical example is this 1500 KVA double-ended unit substation, designed to meet the special requirements of a Lexington, Kentucky, plant. Flexibility for future expansion and complete safety without service interruption were essential. The following features are incorporated in the unit:

Main breakers are 1200-ampere air circuit breakers

Feeder breakers used to feed Square D plug-in duct, are molded case breakers

Tie-in breaker is key-interlocked to permit tying units together when operating on one transformer in an emergency

Interrupting capacity of all molded case breakers exceeds the total maximum available short circuit current, including 100% motor contribution

By the proper application of molded case breakers, Square D engineers achieved a substantial reduction in both the size and the cost of the substation—and with no sacrifice in performance.

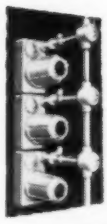
For the complete story of Square D coordinated design, write Square D Company, 6060 Rivard Street, Department SA, Detroit 11, Michigan.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

DANGER!

. . . instantly signaled by Crouse-Hinds *Visularms*®

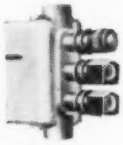


Condulet Visularms

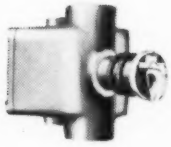
Condulet Pilot Lights

Condulet Horns, Bells & Sirens

Condulet Instrument Housings



Condulet Pushbutton Stations



Condulet Selector Switches

In oil refineries, chemical plants, synthetic rubber plants — wherever constant watch of processing is necessary — Crouse-Hinds Condulet® *Visularms* provide visual indication of process conditions, and instant control of manufacturing equipment.

By means of pilot lights (and bell, horn or siren signals where desired) *Visularm* indicates normal or abnormal temperature, liquid level, pressure, or other conditions which can be electrically coupled to the circuit.

Explosion-proof or dust-tight and weather-resistant construction* assures maximum safety in hazardous locations. Compact designs minimize space required on control or panel boards . . . are easy to install.

A Visularm system delivers substantial savings by eliminating the necessity for buying individual components . . . housing them . . . and wiring your own system completely.

Two- or three-light styles may be mounted either vertically or horizontally. For audio warning, any number of *Visularms* may be used to operate a single horn, bell or siren.

Visularms are just one of hundreds of items in process control board equipment offered by Crouse-Hinds. Only a few are shown at left. For full information on the complete line, call your nearest Crouse-Hinds distributor, or write . . .

*Dust-ignition-proof.

CROUSE HINDS

MAIN OFFICE AND FACTORY: SYRACUSE, NEW YORK

Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

• CONDULET® ELECTRICAL EQUIPMENT (Explosion-Proof and Conventional) • FLOODLIGHTING
• TRAFFIC CONTROL SYSTEMS • AIRPORT LIGHTING and WEATHER MEASURING EQUIPMENT

These products are sold exclusively through electrical distributors. For application engineering help, contact one of the following offices: Baton Rouge Birmingham Boston Buffalo Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Philadelphia Pittsburgh Portland, Ore. Salt Lake City St. Louis St. Paul San Francisco Seattle Tulsa Washington **Resident Representatives:** Albany Atlanta Baltimore Charlotte Chattanooga Jacksonville Reading, Pa. Richmond, Va. Shreveport